The Mining Journal

London, September 22, 1961

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Vol. 257 **No. 6579**

Established 1835

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Published each Friday by
THE MINING JOURNAL LTD.

Directors
E. Baliol Scott (*Chairman*) — U. Baliol Scott (*Managing*)
G. A. Baliol Scott — R. A. Ellefsen

15 WILSON STREET, LONDON, E.C.2

Telegraphic Tutwork, London, E.C.2
Telephone MONarch 2567 (3 lines)

Annual Subscription £3 15s. Single copy ninepence

How Firm is Copper?

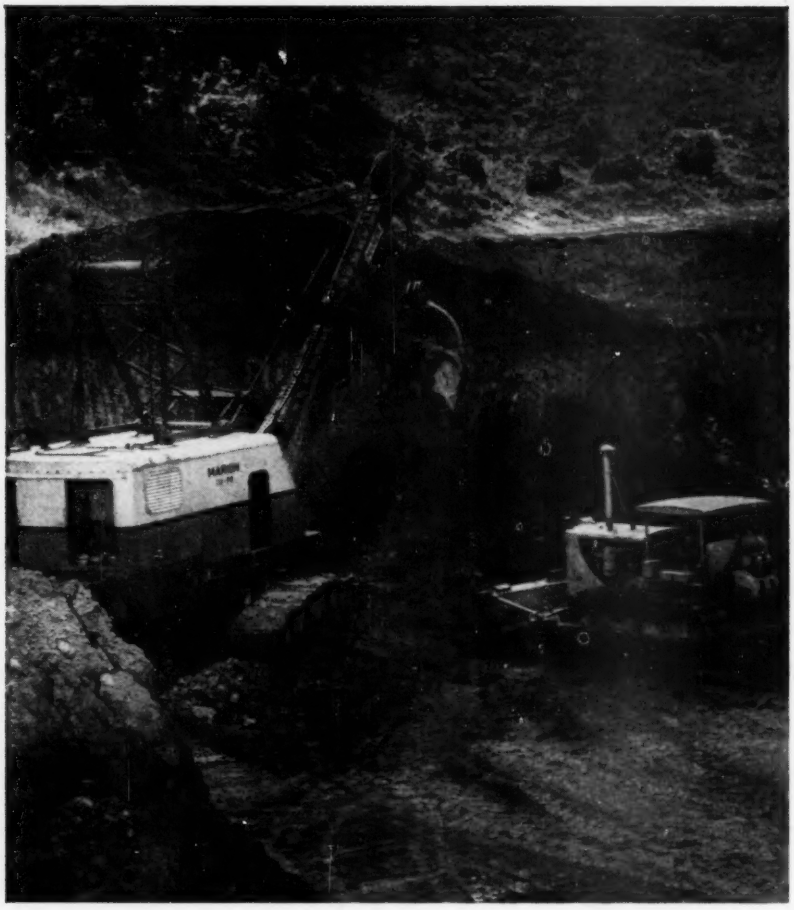
COINCIDENT with the resumption of work at struck mines and plants in Chile and the United States, a new threat to the stability of world copper supplies has been presented by U.N.'s attempted *coup d'etat* in Katanga. Paradoxically, U.N. military intervention in the interests of a United Congo has precipitated the very situation which it was intended to avoid; in consequence, the outlook for Katanga copper has become more uncertain than at any time since Congo independence. Nor does the situation in Chile look at all reassuring, since the present dispute has yet to be settled and, as stated in our last week's issue, negotiations on the renewal of two agreements are pending. Finally, the constitutional problem in Northern Rhodesia remains unsolved; while it seems highly improbable that political issues will have any major impact on Rhodesian production, the present crisis has injected a further element of uncertainty into the copper market.

Throughout the strikes in Chile and the United States L.M.E. prices have displayed a stability which is the more remarkable in view of the political difficulties in the Congo and the Rhodesian Federation. The undertone has remained more or less consistently firm, but there has been little upward pressure. No doubt this was due in part to the holiday season, coupled with the high level of U.K. stocks which now stand at 183,000 tons, but to some extent it must also have reflected consumer confidence in the adequacy of Free World supplies.

The continued existence of voluntary cutbacks in output or sales is, of course, *prima facie* evidence of basic weakness. In the United States, however, a tight supply position has developed and is expected to persist for the next two months. Both Kennecott and Phelps Dodge are back to full production. Early in August it was reported that Phelps Dodge's excess stocks of copper carried over from 1960 were liquidated in the first half of 1961, the company's sales of metal exceeding production in both the first and second quarters. Elsewhere evidence of a tightening supply position is indicated by the premiums which Japanese and other buyers have been prepared to pay for electro copper.

With the dollar and sterling markets for copper now tending to move in opposite directions, the time is perhaps appropriate to take another look at the statistical position, as indicated by the latest available figures.

In January this year Free World annual capacity, in terms of refined copper was approximately 4,000,000 tons, whereas Free World consumption amounted in 1960 to about 3,600,000 tons. On the basis of 1961 capacity and 1960 consumption, the indicated surplus was thus 400,000 tons. At the beginning of the year it seemed probable that half this gap would be closed by voluntary cutbacks and that increased consumption outside the United States would reduce it by another quarter. The remaining 100,000 tons, it was rather more tentatively projected, might be taken up by a revival in United States demand. On the whole, therefore, indications seemed to point to an approximate balance between supply and consumption during the current year.



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In point of fact, up to and including July consumption as based on deliveries by producers) was up on 1960 by 4,000 tons outside the United States and by 47,000 tons in America itself. U.S. fabricators have great hopes for the ast quarter of this year and with the economy rapidly aining momentum it now looks as though the hoped for ncrease of 100,000 tons in American consumption may e exceeded. In Europe consumption seems to have become tabilised for the time being on an extremely high plateau nd so far there is no sign of any falling off in demand. n Germany, for instance, the figure for May was substantially igher than the average for 1960. In France consumption f refined copper (including secondary) was back in June to he peak attained in March and is again well above the verage for 1960. In the United Kingdom the fall in consumption indicated by the latest available figures has not been very steep, the July total being 48,780 tons compared with 54,273 tons in December, 1960. Present indications suggest, therefore, that outside the United States the overall ncrease in consumption should comfortably exceed 100,000 tons.

Now that Kennecott and Phelps Dodge are back in full production, the voluntary cutbacks have been reduced to an annual rate of about 120,000 tons. So far as the supply-consumption equation is concerned, however, the additional metal now arising from the higher outputs of these two companies is more than offset by the loss of 60,000—65,000 tons resulting from the strikes in Chile and the United States. Assuming that the existing cutbacks are maintained, that the recovery of the United States economy comes up to present expectations, and that no sharp contraction in consumption takes place elsewhere, copper's statistical position is beginning to look pretty healthy. There is also the possibility that nervousness about the situation in Katanga will lead to a build-up of consumer stocks. In fact, it seems questionable whether, at this point, the price structure would be seriously weakened if the remaining cutbacks were discontinued.

In the United States stocks had fallen at the end of July to 82,856 tons, which compares with 139,272 tons at the end of December 1960 and is equivalent to less than a month's supply. On the other hand, there has been a persistent rise in stocks held outside the United States, which amounted to 340,825 tons at the end of July as compared with 288,510 tons at the end of 1960. Even the former figure, however, represents only about six weeks' supply at the present level of consumption. Overall, the level of Free World stocks is virtually unchanged from the end of 1960.

On the statistical evidence there seems no reason to anticipate any setback to copper in the short-term, while further strikes in Chile or disruption of the Katanga production could well send prices higher. In the latter event, however, some protection against physical shortage of metal would be afforded by the stockpile resulting from Anglo American's policy of cutting back sales instead of production. It is evident, however, that Anglo American cannot afford to go on stockpiling indefinitely. In view of the improving statistical picture, the time may not, in fact, be far distant when the two Rhodesian groups will consider it expedient to suspend their present restrictions on output or marketing. As for the present weakness of the market this seems unlikely to persist for very long.

In the long-term copper's future depends, of course, on the ability of the industry to maintain and expand its market in the teeth of growing competition from other materials. With efficient market research and aggressive salesmanship this should not be too difficult, having regard to the rapid expansion of the electricity supply industry and other major markets.

THE WRONG ROAD TO CONGO UNITY

Just as the prospect for a united Congo was beginning to look rather less remote, the clock has been put back by U.N.'s abortive military intervention in Katanga, and by the tragic death of Dag Hammarskjold on his way to peace talks with President Tshombe. Now, at the time of going to press, a provisional cease-fire has been arranged but it has yet to be seen how effective this will prove to be.

A few weeks ago (*The Mining Journal*, July 21, 1961, p. 39), we expressed the view that the sands of Katanga's independence were running out, among the reasons given being that Belgium's new government had switched its support to U.N.'s policy of Congo unity, U.N. troops had occupied key positions in Katanga, while even Union Minière was said to be in favour of a pact with the central government that would reopen the Congo transport routes. With the dice so heavily loaded against them, it seemed only a matter of time before M. Tshombe and his advisers agreed to negotiate with Leopoldville, particularly in view of the moderate and conciliatory approach adopted by M. Adoula.

Whatever the motives that impelled Dr. Conor O'Brien, U.N. representative in Katanga, to order the use of force against M. Tshombe's government, the effect of this misguided adventure has been to precipitate the civil war which it was presumably intended to prevent. In view of the critical importance of Katanga's mineral wealth to the Congo Republic as a whole, a strong case can doubtless be made out on the score of expediency for trampling on the aspirations of this particular minority. A *coup d'etat* can only be justified, however, when it is successful; this one was not. While M. Tshombe is not without his faults it can scarcely be disputed that under his administration Katanga has been well governed as compared with the Congo's other Provinces. It is one of the ironies of history that an operation undertaken in the interests of peace should have resulted in the most serious threat to the continuity of Union Minière's mine and metal production since the birth of the Congo Republic.

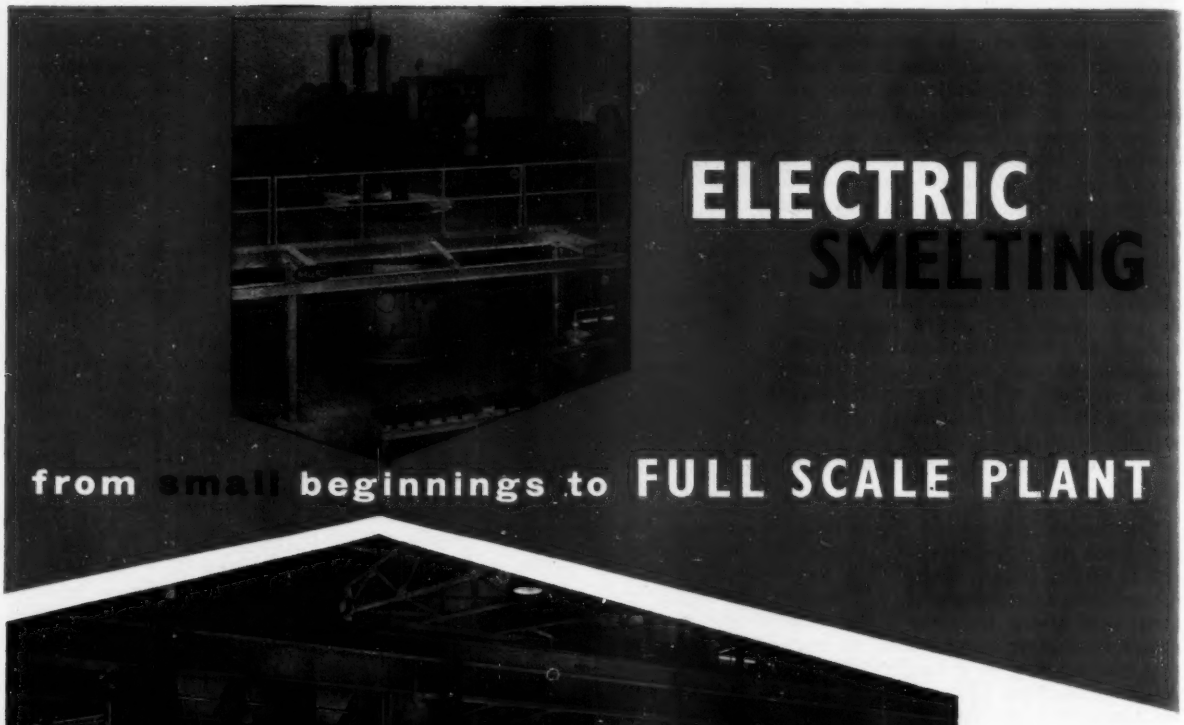
According to Union Minière's latest statement, the company's plants at Lubumbashi have ceased work. At Kipushi, a mine located 30 kms. from Elisabethville, close to the Rhodesian frontier, work was resumed on Friday, September 15, after a stoppage of two days. The plants at Shituru, near Jadotville, and at Luilu, as well as Mètalkat's zinc plants near Kolwezi, have been operating at a normal level since September 15, following two days of operations at reduced capacity. Hydro-electric stations are reported to be functioning normally.

Union Minière's official reaction to the events which have precipitated the present crisis has not been disclosed. The company states that neither its employees in Katanga nor their families have left the district during the present troubles, but no indication is given as to whether any of its European staff are among the white officers fighting with the Katanga army.

DEEP DRILLING IN THE U.S.S.R.

Less spectacular than the race to be first on the moon, and certainly much less publicised, is the deep drilling contest which has arisen between America and Russia, both of which are currently engaged in attempts to reach the comparatively unknown boundary between the crust and inner core of the earth known as the Mohorovic discontinuity.

(Continued overleaf)



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The Americans are attempting to reach the Mohorovic yer by drilling a hole under some 12,000 ft. of water near uadelupe Island off the Mexican Pacific Coast. This oject was briefly described in *The Mining Journal*, arch 10, 1961, p. 259. Russia, on the other hand, has plans r a programme of deep drilling which will give a picture all rock layers in the earth's crust—sedimentary, granitic d basaltic—and will show the mineralization processes them.

On August 25, 1961, the "Collegium" of the Soviet inistry of Geology met in Moscow to discuss this venture. he conference decided on a preliminary project, involving e drilling of holes up to 15-20 kilometres deep at five fferent points inside Soviet territory. Hole No. 1 is to drilled in the Caspian depression. It will pass through the ickest layer of sedimentary rock in the world before aching the continental foundation rocks at 12-14 km. ole No. 2 will be drilled in Karelia and will pierce the dest granite layers down to a depth of about 15 km. ole No. 3 will be drilled in the Urals, to find the bottom" of the Ural mineral "treasury box". Hole No. will be drilled in Azerbaidzhan to study the structure of he basaltic rock, which is the lowest level of the earth's rust. Hole No. 5 will be drilled on one of the volcanic urile Islands, where the crust is very thin. This hole is ntended to reach the Mohorovic layer.

In discussing the technical aspects of this project, Professor Y. V. Kravtsov stated that the Soviet Union already had the technical capacity not only to drill holes to such depths, but even to build a shaft of 20 km. depth. On the available evidence, however, it seems that so far the technique of hole drilling has been mastered in the U.S.S.R. only to a depth of about 3,500 m. At present about 70 drill holes to a depth of 4,000 m. are being put down, but all drilling beyond 3,500 m. still ranks as an "experimental" venture. Only one hole—in Azerbaidzhan—has been sunk down to 5,040 m., but ten more holes of a similar depth are now being drilled. It would appear that at the present time equipment for drilling to depths of between 5,000 and 7,000 m. exists only on drawing boards. For depths ranging from 7,000 m. to 10,000 m., no equipment has as yet been projected and no methods have been studied.

Holes 2,000 m. deep are to be drilled in about a month, in the U.S.S.R., but thereafter the drilling speed drops considerably—to 300-400 m. per month. Between 4,000 and 5,000 m. the drilling speed does not exceed 100 m. per month and the cost per m. is 600 per cent greater than in shallow drilling. Turbo drills and electric drills proved ineffective at the greater depths and light alloy tubes of small diameter appear to be needed.

Soviet scientists attach the same importance to these deep drilling ventures as to cosmic research, but indications are that the Americans might be the first to reach the Mohorovic layer.

MINERAL FINDS IN BRITAIN

Substantial progress in detailed geological mapping throughout Great Britain is described in the 1960 Report of the Geological Survey and Museum. (Published for D.S.I.R. by H.M.S.O., Price 5s. (U.S.A. 90 c.) by post 5s. 5d. As an outcome of this and other research, some discoveries of economic significance were made during the year. These include finding coal seams in Oxfordshire, a bed of anhydrite in Northern Ireland, in both cases of workable thickness, and that the reserves of salt in Cheshire are double the previous estimates.

The discovery of coal in a borehole at Apley Barn, Witney, about 10 miles from Oxford, was announced on July 20, 1961. It is the first coal to be found in Oxfordshire of a workable thickness. Coal Measures were proved from 820 ft. to 3,968 ft. and boring ceased on August 22 at a depth of 4,942 ft. (*The Mining Journal*, July 28, 1961, page 99). This work was part of the Geological Survey's long-term programme of borehole drilling undertaken to obtain information on the relationship and composition of the deeper rocks in Southern England, and was the third borehole commissioned by the Survey between the River Severn and Oxford.

The discovery and assessment of great additional resources of salt in Cheshire by the Survey's programme of boring has already been made known. The reserves of salt are now estimated as at least 400,000,000,000 tons, twice the amount which could previously have been reasonably estimated. The cores of salt from these boreholes are being analysed in the laboratory of the government chemist so that details may be made available for industry.

The Geological Survey of Northern Ireland, set up in 1947, is now closely integrated with that of Great Britain. A borehole was put down to a depth of 600 ft. at Avoniel, in East Belfast, to test the opinion, suggested by surface mapping and old records for boring for water, that anhydrite (an anhydrous form of gypsum) or gypsum itself might be present in commercial quantities. Drilling was completed early in 1960 and 16 ft. of massive anhydrite were proved between 365 ft. and 381 ft. depth below surface.

Approximately two-thirds of the Atomic Energy Division's effort throughout the year was in support of the A.E.A.'s beryllium assessment programme being undertaken mainly in Southern Rhodesia and East Africa. Field investigations in the U.K. were concerned principally with completing the examination of anomalies noted during reconnaissance and aeroradiometric surveys. No uranium occurrence has yet been shown to be of economic interest. However, the uranium-bearing veins discovered along the Kirkcudbrightshire coast in 1959 are of sufficient extent at surface to justify a diamond drilling programme.

Extensive car-borne scintillometer surveys of the Lake District, north and central Wales, and Northern Ireland, revealed no evidence of significant uranium mineralization, but were of considerable value in proving a new technique of survey in which the scintillation probe is mounted on the vehicle at a height of 10 ft. above road level.

MINERALS IN AFGHANISTAN

The exploitation of mineral deposits is to play a leading role in the further industrialization of Afghanistan, according to a recent statement from Kabul. Reserves of copper ore, lead ore, iron ore, tin ore, chrome ore, gold, silver, asbestos, mica, marble, talc, mineral oil, natural gas, hard coal and brown coal have already been found in the country, as well as salt deposits. Mineable beryllium deposits are also known to exist, but exploration is still in hand.

Recent coal finds have been of some 10,000,000 to 12,000,000 tonnes in the Mazar-i-Sharif area; current coal output is only of some 34,000 annual tonnes in Afghanistan. Considerable mineral oil and gas deposits have recently been determined in the north of the country by Cominform-bloc geologists, the total national oil reserves now being put at 45,000,000

Columbite and Pyrochlore

By J. Sandor, D.I.C., A.M.I.M.M.

TECHNICAL reviews of columbium in the last few years have frequently referred to the mineral "pyrochlore", but up to the present time the existence of large reserves of this mineral has been something of an enigma in the practical assessment of the future availability of columbium.

In Norway a type of pyrochlore (koppite) has been mined and marketed successfully as a source of columbium throughout the world for many years. A common feature of many of the pyrochlore deposits discovered during the last decade in various parts of Africa and elsewhere is their considerable size, each running to the order of 100,000,000 tons of ore, and some greatly exceeding this figure.

Essentially, pyrochlore is a complex alkaline earth niobate, covering a whole range of chemical composition. Moreover, these pyrochlore deposits exhibit important differences in accessory mineralization, complexity and other factors, each one presenting its own difficult mineral processing problems. It is not surprising, therefore, that there has been a long delay between the announcement of the discovery of substantial ore-bodies and the first reliable news of any serious moves towards full-scale production. Some of the treatment problems of a few of these deposits have so far proved economically intractable (see Table). There is, as yet, no known flotation reagent universally applicable to all pyrochlores, although a process recently patented in Canada (Canadian Patent No. 602917, August 1960) appears to show more promise for columbium bearing ores generally than any which has been suggested hitherto.

There are, by now, a number of important mining projects in train (see Table) which should result in releasing on the market substantial quantities of pyrochlore concentrate in the very near future. This will create an interesting situation, full of intriguing possibilities. The producers of columbite in Nigeria and elsewhere are, of course, vitally concerned in these developments.

Far too little is known about costs of production of either columbite or pyrochlore for any comparisons to be other than entirely speculative. Nevertheless, the basic production steps are such as to permit suggesting (without first-hand knowledge) that the present break-even point for by-product columbite from alluvial tin ores, is probably around 3s. per lb. contained pentoxide. This is a computed figure, going back to first principles of ore dressing costs. It is likely that a similar, if somewhat lower figure applies also for most of the large-scale pyrochlore prospects, if based on a type of ore such as exists at Araxa, Brazil.

Mr. Sandor is head of the Process Economics Group, Warren Spring Laboratory, D.S.I.R. His article is published by permission of the Director, Warren Spring Laboratory, Department of Scientific and Industrial Research, but the contents represent the author's personal views

There is, of course, hardly any likelihood of prices reaching such low levels, so far as it is possible to foresee. Competition is bound to increase, however, with the appearance of large quantities of pyrochlore. One must bear in mind that at this time there is no scarcity of columbium[1] and, moreover, as far as columbium is concerned, we are not likely to experience ever again the artificial situation of the early 50's.

It is only to be expected, of course, that if prices of the ore will eventually tend to find a lower level, this will also be reflected in the price of ferro-columbium which, in turn, should result in a wider demand for it in steel. The latter is likely to remain the most important outlet for columbium within the foreseeable future, and it includes such growing applications as columbium-containing mild steel.

Furthermore, if one considers the problem of costs in isolation, with all that it implies in reflecting a balance between demand and supply, it is most unlikely that any substantial new demand, as a result of some recent develop-

IMPORTANT NEW PYROCHLORE PROSPECTS

	Cb_2O_5 in ore per cent	*Starting Production (Planned)*	*Expected Grade Cb_2O_5 per cent*	*Possible By-products*	*Expected scale of production of Cb_2O_5; Initial stage (Long tons per annum)*	*Remarks*
ARAXA, Brazil						
Wah-Chang, Mocorp. & Govt. of Brazil	3-4	Started	55	Rare earths	1,500	Vast reserves
OKA, Canada						
Columbium Mining Products	0.35	1962	45	Apatite	335	Large reserves
St. Lawrence Columbium	0.5	end of 1961	50	—	450	,,
SUKULU, Uganda						
Tororo Industrial Chemicals & Fertilizers..	0.3 (soil)	1962	55	Phosphate Fertilizer	40	Large reserves May produce more later.
MRIMA HILL, Kenya	0.2-2 (soil)	—	—	—	—	Large reserves Under investigation
MBEYA (Panda Hill), Tanganyika						
Billiton and Colonial Development Corp.	0.2-0.4 (Rock)	—	50-55	—	—	Large reserves Pilot plant investigations in progress.
LUESHE, Lake Kivu, Congo	—	—	—	Apatite	—	Large reserves Under investigation.

ment, or discovery of new applications for columbium, will coincide with the imminent appearance of large quantities of pyrochlore on the market. So much for the immediate future. Beyond that, prospects for both columbite and pyrochlore appear bright owing to the steadily growing uses of columbium over a wide field.

Technical Considerations

Whilst the foregoing would indicate that the appearance of thousands of tons of pyrochlore might depress the columbite market, there are still important technical considerations which are by no means fully clarified. Firstly, it is likely that many of the future pyrochlore concentrates will be produced by processes in which flotation will play an important part, and these flotation concentrates will be relatively fine-grained. Moreover, owing to the complex nature of pyrochlore mineralization, the ore will have to be finely ground to liberate the values. It follows that the concentrate will contain a considerable proportion of fines and will generally be more finely divided than columbite. It is not yet known to what extent this will affect the recovery of columbium in the production of ferro-columbium. If this is serious, the producers may be forced to agglomerate the product in some way. Secondly, the chemical composition of pyrochlore concentrates will require scrutiny. If the product is ferro-columbium for stainless steel, a number of impurities will have to be kept below certain limits. Phosphorus, in particular, will need careful watching. One of the consequences of the difficulties of pyrochlore concentration will also be evident from the fact that the grade of concentrate is likely to be considerably below that of columbite. This, in itself, should not prove a serious problem, but owing to the larger proportion of slag-forming substances, recoveries in ferro-columbium may be affected. Thus, both the fineness of the concentrate and the proportion of slag-forming constituents may adversely affect recoveries in ferro-columbium production.

There has been a trend recently to produce a low-ferro-columbium alloy (40 per cent Cb) for mild steel application and, in this connection, it is worth noting that in the production of some pyrochlore concentrates, finely divided magnetite is an unwanted by-product. It would be an over-simplification to state that it ought to be possible not to remove this magnetite and thereby reduce the cost of concentration. Furthermore, the process in question may not permit such a course if any concentration at all is to be achieved. Nevertheless, it is unlikely that producers, or potential producers of pyrochlore fully appreciate, at present, that a concentrate which assayed, for example, 60-65 per cent combined $Cb_2O_5 + Fe_3O_4$ with a Cb/Fe ratio of 3 : 2 might be a saleable product. Such a concentrate would contain only around 37-40 per cent Cb_2O_5.

The fact that prior de-tinning becomes unnecessary if pyrochlore is employed in ferro-columbium production for stainless steel applications, might be an economic advantage. This fact may counterbalance to some extent—in the economic sense—slightly lower recoveries in ferro-columbium production from pyrochlore.

In certain nuclear applications the fact that some pyrochlores possess no more than traces of tantalum (Cb/Ta > 200 : 1) will be a definite advantage and will assure for such concentrates a distinct, if at present small, market.

So far only sample lots and comparatively small parcels of pyrochlore have reached potential customers from the new deposits, and tests on them are by no means complete. While immediate plans for full-scale production have been announced at various localities, it is only natural to expect some early teething troubles at these entirely new mines and concentrating plants. It would be wrong to assume, however, that production will be delayed much longer. By this time next year enough should be known to warrant another brief report on the situation.

International Columbium Council

Negotiations are in progress to set up an International Columbium Research and Development Council. This would consist of all the important producers of columbium-bearing ores and it has been proposed that a form of associate membership should be open to producers of ferro-columbium and other columbium products. The aim will be to promote the uses of columbium by research and dissemination of information. There should be plenty of scope for such an organisation. If adequately supported, it will fill a long-felt need and provide the expression of purpose common to both columbite and pyrochlore producers, namely the increased use of columbium in all shape or form. Many experts believe that the consumption of ferro-columbium in steel could be almost doubled within a relatively short time, if only a serious effort were made to publicise its advantages to the final user. In those circumstances, both columbite and pyrochlore production could be absorbed without creating serious problems.

Strange as it may seem, even in these days one comes across otherwise well-informed persons in the steel and engineering industries, who appear to be grossly ignorant of the potential abundance of columbium from readily available sources. Not infrequently, the decision to use a less suitable alloying element is wrongly made owing to an ingrained anxiety over the future availability of columbium. To allay these fears will no doubt be the first objective of the new Council.

(1) J. Sandor, "Niobium (Columbium) - Its Future Prospects," Metallurgia, Vol. 59, No. 354, April 1959.

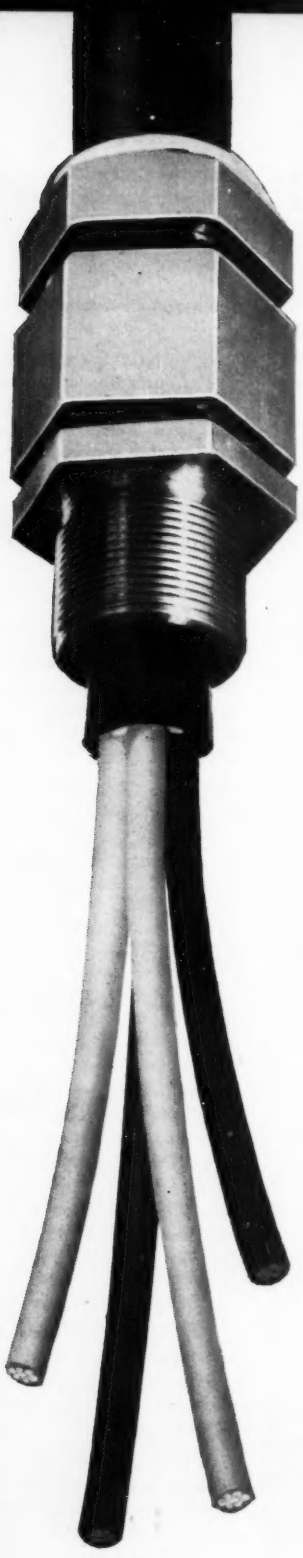
Dry Land Dredging

A NEW method for mining gold from arid desert placer deposits is being put to work in the San Domingo and Weaver areas, about 50 miles northwest of Phoenix, Arizona. The gold is being mined by a dry land "dredge" that operates without water. The new process was developed by United Placer Industries, Inc. It has been described in *American Metal Market*.

The dredge can process 50 to 75 cu. yds. of gravel per hr. The company plans, in the near future, to build larger dredges with capacities of 500 to 1,000 cu. yds., or more per hour. Simultaneously, the dredges can produce by-product minerals.

The dredge uses the same general type of operation as a floating dredge, except that no water is used either for moving the machine or separating the gold. Mounted on a trailer truck platform, the dredge stands 18 ft. high and is powered by a portable diesel generator. It can be operated continuously by a two-man crew.

In operation, the placer deposits are scooped by a conveyor into a huge hopper where all large size rocks and debris are quickly rejected by a grizzly. The gravel then is sifted through a series of graduated vibrating screens until only sand of a pre-determined size passes through. All larger material is thrown off. The accepted material is then conducted upwards on a conveyor covered with a battery of butane-fired, infra-red heating units. The moisture is quickly aerated and the dried material dropped on to six electro-static separator tables where normal recovery methods produce a product of 90-95 per cent purity.



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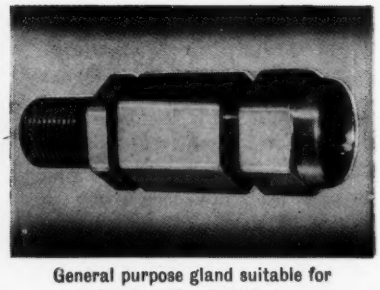

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CABLE PLANTS

The Mineral Deposits of Hong Kong

THE British Crown Colony of Hong Kong comprises Hong Kong Island (29 sq. miles); the ceded territory of Kowloon on the Chinese mainland (3½ sq. miles) and Stonecutters Island (¼ sq. mile), both of which were added to the Colony by the 1860 Convention of Peking; and the New Territories, which includes all the land north of Kowloon up to the Chinese border and 235 adjacent islands or islets (in all about 365 sq. miles) leased from China for 99 years from July 1, 1898.

On Hong Kong Island itself is the sprawling capital city of Victoria, the business centre. The ceded territory of Kowloon is the industrial and shipping centre.

The New Territories are mostly deeply hilly and barren but in this small area there are probably more varieties of minerals to be found than in any other comparable area of the world. Here, in the rocks, have been recorded occurrences of argentiferous galena, wolframite, molybdenite, garnet, pyrite, mica, magnetite, hematite, cassiterite, sphalerite, graphite, kaolinite, feldspar, topaz, beryl, fluorspar, quartz and gold.

There is archeological evidence to show that some 3,000 years ago local quartzites and clays were being worked for the fashioning of simple vessels. Metallic minerals, however, do not appear to have been exploited until Portuguese and Chinese companies began mining for lead and silver in the nineteenth century.

Today iron ore, graphite, wolframite, kaolin, quartz and feldspar are being economically exploited. Exports of these minerals in 1960 were valued at $HK6,126,695.

The mineral of greatest economic value is iron ore, which is being worked by a local company. The Ma On Shan mine in 1960 produced 117,043 tons of concentrated iron ore, valued at $HK5,272,770. The total output is exported to Japan.

The mine, originally prospected in 1906, has been in successful operation since 1949. Original working was by open casting but in 1957 working was completely converted to underground. The magnetite as mined has an average Fe content of 32 per cent; this is concentrated by wet magnetic separation to produce an ore of 56 per cent Fe for export. The ore dressing plant can handle 700 tons of crude ore a day. Following diamond drilling, development is now planned below the present 240 and 280 m. levels. Reserves are estimated at around 10,000,000 tons of iron ore. Prospecting continues in the vicinity of the operating mine and on Lantau Island.

No lead has been mined in the Colony since 1958.

Wolframite is worked by underground methods at Needle Hill for export, mostly to the U.S.A. In 1960, 11,165 tons of crude ore were produced from which 31.21 tons of 65 per cent WO_3 concentrates were obtained by hand cobbing, crushing, screening and sluicing.

Graphite is mined by underground working at about 250 feet below sea level on the West Brother Island, where it occurs as a seam in sedimentary rocks. The mine was opened in 1952, and in 1960 produced 2,624 tons of high grade and 1,175 tons of low grade graphite. Grades with a fixed carbon content of over 75 per cent are exported, in lump form after hand selection, to Canada, U.S.A., Japan, Thailand, United Kingdom, India and Formosa. Exports in 1960 realised around $HK200,000. The low grade graphite containing 50 per cent or less fixed carbon is used as fuel in domestic brick factories.

PRODUCTION OF MINERALS

(in l. tons)

Mineral	*Average %*	1958	1959	1960
Feldspar	—	1,653	1,716	2,511
Graphite	Fixed carbon 80%	1,934	1,925	2,624
,,	Fixed carbon 50%	N.A.	1,358	1,175
Iron ore	Fe 56% (conc.)	—	119,893	117,043
,,	Fe 46% (lump ore)	105,125	—	—
Kaolin	—	7,621	7,256	6,663
Lead Ore	Pb 54%	36	—	—
Quartz	—	4,484	3,571	3,812
Wolframite	WO_3 65%	38	39	31

Source: Directory of Commerce, Industry & Finance.

Most of Hong Kong's production of kaolin is exported to Japan, whilst quartz and feldspar are produced solely for local consumption.

Prospecting continues for deposits in economically workable quantities of other minerals of which occurrences have been noted.

Prospecting licences may be granted for periods of six months, renewable up to a maximum of five years. Mining licences are granted for similar periods. The maximum term for a mining lease is twenty-one years. The Government takes a royalty of five per cent of the value of all minerals won.

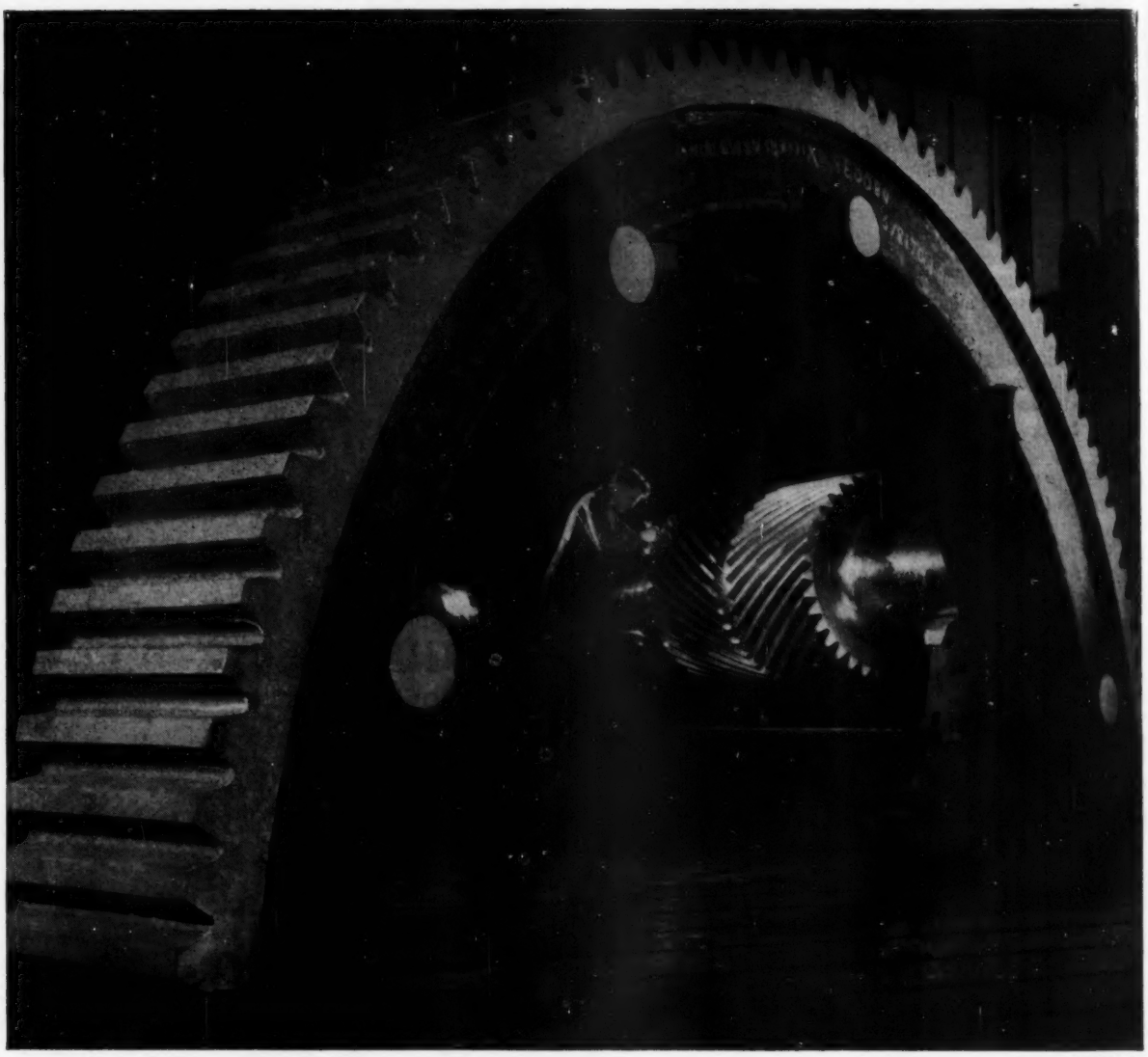
India's Search for Minerals

PRELIMINARY investigations of magnesite in the Pungar and Lahore valleys of Almora show that approximately 14,500,000 tons of magnesite would be available. The State Government proposes to intensify all mineral investigations in the Uttarakhand Division.

Intensive drilling and geological mapping in the Kajrahat Limestone at Kota, Mirzapur, has revealed a reserve of 20,000,000 tons of cement quality limestone. Five thousand tons of calcite, occurring at Parosi in Mirzapur, have been found suitable for the chemical industry.

Preliminary investigations carried out by the Geological Survey of India now confirm the occurrence of iron ore deposits in the Nilgiri district of Madras State. However, the nature and distribution of the occurrences call for detailed prospecting. The iron ore bearing rocks of this region consist of magnetite, hematite and quartz in varying proportions. In places limonite is also associated. The rocks belong to the Dharamwarian age. It has been estimated that these deposits contain about 1,200,000 tons of ore with an iron content varying from 49.69 to 63.95 per cent, as well as 6,380,000 tons containing at least 36.91 per cent of iron. It is believed that if the survey work is extended to other virgin areas, similar occurrences may be found. Systematic mapping of the district may also bring to light other iron ore deposits of the Dharamwarian ferruginous quartz rocks.

Promising results are indicated by recent investigations carried out by the Directorate of Geology and Mining in Uttar Pradesh, where a mineralized belt of asbestos in the district of Chamoli has been found to extend for 12 miles. Asbestos mineralization in Jalai, Singoli, Phawali and at Kunia is being evaluated and rough estimates show the presence of 300 cu. ft.



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SURVEY OF MINERAL WEALTH IN PAKISTAN

THE Bureau of Mineral Resources has started an extensive survey and exploitation of mineral wealth throughout Pakistan.

It is further reported that the United States has agreed to assist the Government of Pakistan in expansion and acceleration of mineral resources exploitation and development. Under the agreement, the United States will increase the existing geological advisory services at the Quetta headquarters of the Pakistan Geological Survey with a view to carrying out the Second Five-Year Plan programme.

A key area where geological survey activities will be stepped up is the Hazara District, which contains the largest number of known mineral showings of any area of comparable size in Pakistan. Tungsten, lead, manganese, iron and titanium minerals have been found in the district and possibilities exist for the discovery of significant deposits of rare metals and rare earths.

To meet this expanded and accelerated programme, the U.S. Operations Mission in Pakistan is tentatively planning expenditure of $1,358,400 for the fiscal year 1961 and 1962. The United States has been assisting Pakistan in the establishment of a Pakistan Geological Survey since 1956.

Other projects in the programme include the development of coal resources in the Sor range, Daghar area, mineral resources of the trans-Indus range, coal resources in the Khost-Sharigh area, chromite resources of the Hindubagh area and studies in the lower Indus basin.

Japan may also help Pakistan in her plans for the exploration and exploitation of mineral resources. A plan in this connection is being worked out by the Ministry of Fuel, Power and Natural Resources. The question of Japanese participation was discussed when an economic mission from Japan visited Pakistan in April. Japan is expected to indicate the extent of her assistance to Pakistan during the next few months.

No Nationalisation of Mining

Referring to the apprehensions of mining industrialists about the nationalisation of the industry, Mr. Z. A. Bhutto, Minister for Fuel, Power and Natural Resources, declared that Pakistan was wedded to the principle of free economy and the Government was pursuing this policy with greater determination.

Mr. Bhutto also said that a Mineral Development Corporation would soon be set up in Pakistan to boost mineral exploitation. A scheme in this connection was under the active consideration of the Government. The Corporation would provide credit facilities to coalmine owners for mechanisation of mines to boost up coal production in the country. It would also provide technical aid to extract coal on scientific lines and improve the conditions of labour.

Quest for Radio-active Minerals

Top officials of the Ministry of Fuel, Power and Natural Resources of Pakistan at a conference in Karachi decided to give greater emphasis to exploration for radio-active minerals.

The conference underlined the necessity to step up the production of exportable minerals like chromite, marble, copper and bauxite. It also decided that the possibilities of utilization of natural gas as raw material for petro-chemical industries should be investigated.

An aerial survey is going on in West Pakistan for the purpose of discovering uranium. Dr. I. H. Usmani, chairman of the Atomic Energy Commission of Pakistan, said that sand on the beaches of the Indus river from Umb right up to Kalabagh was found to be radioactive.

Large deposits of chromite have been found near Tangi, about 30 miles from Peshawar. A plant will be established for the extraction of chromite at Hindu Bagh in Baluchistan where the deposits are spread over many square miles. The Tangi deposits are reported to be very rich and to contain about 60 per cent chromite. Although the ore has not as yet been fully exploited, about 400 tons have already been exported to Switzerland.

Fairly large deposits of celestite have also been found in the vicinity of Thano Boola Khan in Thatta District. Pakistan has entered into negotiations with a foreign Government for a long-term agreement for its supplies.

The Geological Survey of Pakistan has found large deposits of lignite in Dadu district, in an extensive area of about 40 to 50 square miles. The coal reserves in this area are estimated at over 30,000,000 tons. The Government recently granted exploitation and prospecting concessions to about six parties, including the Pakistan Industrial Development Corporation. A sample of this coal has been sent to West Germany for processing and examination.

East German Mineral Output Steady

ACCORDING to final estimates now available for 1960, mined production of lead last year in the Soviet zone of Germany reached the 1959 level of 7,000 tonnes of metal content. Furnace lead output was also unchanged over the year at about 25,000 tonnes. Refined lead consumption is estimated to have remained at the 65,000 tonnes level of 1959.

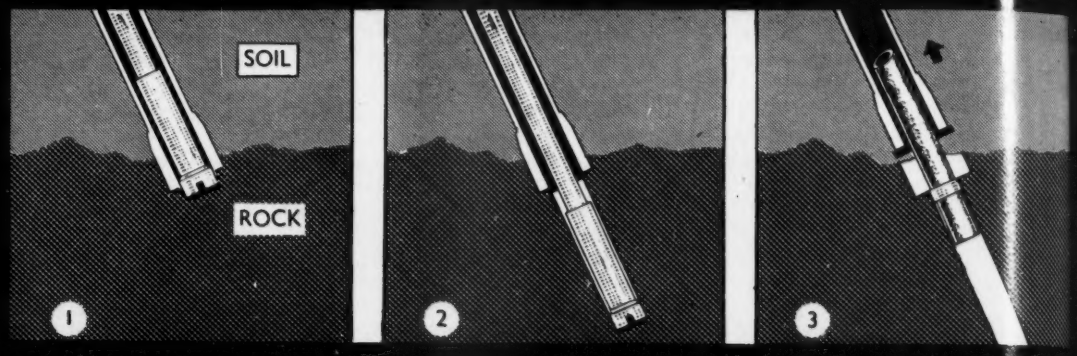
Mined zinc production is also believed to have stayed at the previous year's level, which, as in the case of lead, was some 7,000 tonnes metal content. Raw zinc consumption, however, is estimated to have risen by 5,000 tonnes to 35,000 tonnes over the year. Current East German statements claim that the Bernsdorf zinc white plant in the Soviet zone is now the biggest in Europe.

East German tin production, in long-tons tin content of ore mined, stood at its 1959 level estimated at 720 tons.

Greater use of East German iron ores will be made possible by a new processing method now said to be perfected after three years of research work by a study group at the VEB Bergbau- und Hüttenkombinat Maxhütte, of Unterwellenborn. The new process will result in considerable savings in coke and limestone imports. With it, the iron content of ores mined in the Schmiedefeld and Wittmannsgereuth areas of the Soviet zone can be increased by 6 per cent to a post-roasting share of 45 per cent Fe and that of silicic acid decreased by 6 per cent to a final content of only 14 per cent. The ore thus treated will be fed to the Maxhütte combine's own blast furnace. By-products of the process will go to the building and road construction.

The Non-Ferrous Metal Research Institute, of Freiberg-in-Saxony, East Germany, has entered into a co-operative agreement with its counter part in Czechoslovakia. Initially East Germany is to make available results of research in the field of zirconium semi-products manufacture while Czechoslovakia will share data on the processing of certain other non-ferrous metals to semi-product form.

THE OVERBURDEN DRILLING METHOD



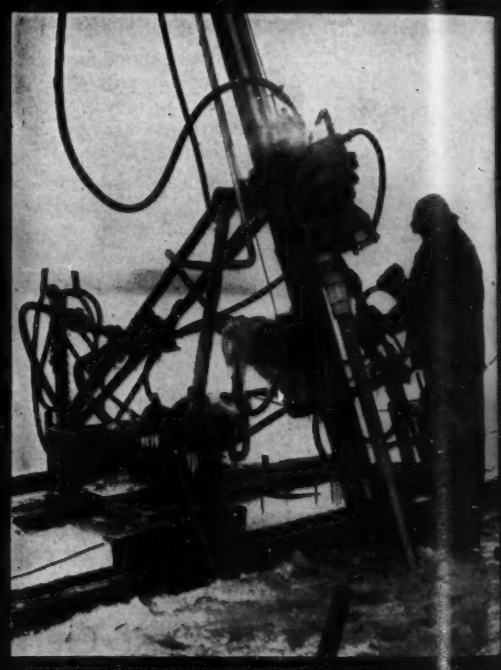
Drilling and blasting bed rock without removing the soil cap

Drilling is carried out using an Atlas Copco rock drill with separate rotation. Extension equipment (left) consists of Sandvik Coromant drill-pipes with ring bit and inner extension steels with cross bit. The bits are tipped with tungsten-carbide inserts.

1. Pipe and steel are drilled simultaneously through sub-soil layers until pipe is collared a few inches in bed-rock.

2. Pipe is uncoupled from drilling action and hole drilled to full depth by inner extension steels alone.

3. Inner steel is withdrawn and replaced by plastic tube. Drill-pipe is removed leaving expendable tube connection between surface and rock for charging.



NEW TECHNIQUE WIDENS SCOPE FOR SUB-SOIL AND UNDER-WATER DRILLING

The Overburden Drilling Method is a completely new technique for drilling through earth strata and under water. It has proved itself simpler, cheaper and more versatile than conventional methods used for grouting, sub-soil exploration, mineral prospecting and similar operations. Underlying boulders are drilled through and reamed without need for blasting or removal. Sampling can be carried out at any stage of the drilling.

The method involves the use of specially developed extension drill-pipes with inner extension steels. These are driven by the Atlas Copco BBE rock drill with separate rotation. By means of a special shank adaptor, percussion and powerful torque are conveyed to the pipe which can be uncoupled from the drilling action. Removal of the inner steels from the pipe leaves an open connection with the surface and widens the scope for a variety of applications.

Overburden Drilling was originally introduced by Sweden's largest contracting company, AB Skånska Cementgjuteriet, for their Lindö Canal project. In constructing this 4-mile seaway to the Baltic about 226,000 cu. yds. of rock and more than 4,500,000 cu. yds. of overburden were blasted and excavated by dredging.

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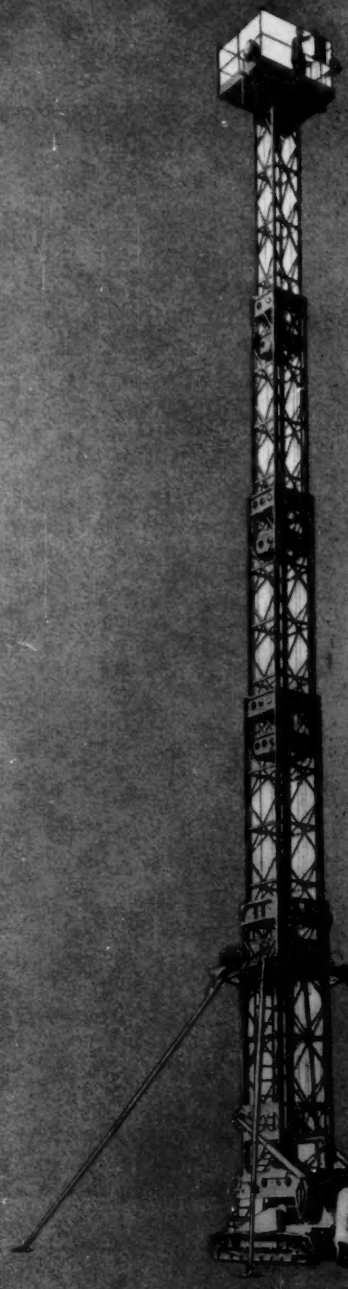

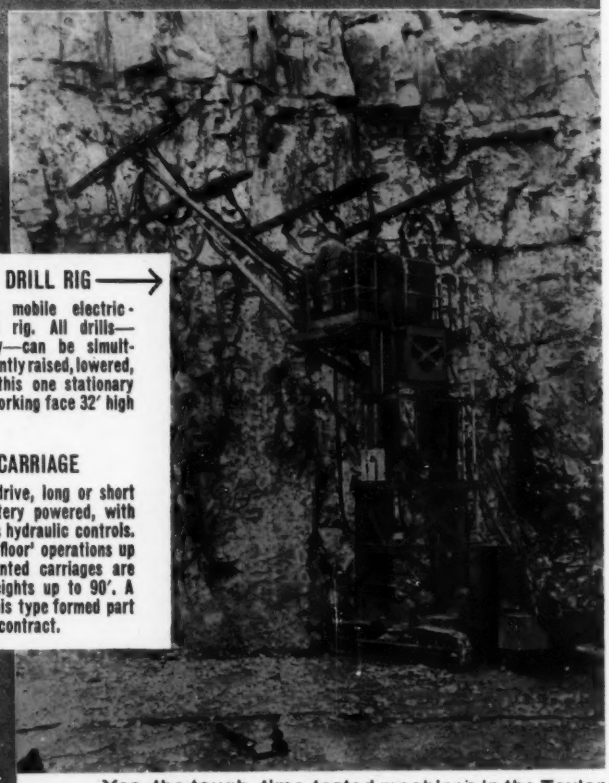

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The Evolution of the Rope Side-Framed Conveyor Structure

THE first attempts to build a mining conveyor using rope for side-frames in place of the conventional rigid steel frames were those of Austin Hopkinson, who worked on this idea during the inter war period. Their British Patent No. 266812 of 1927 disclosed the principle of carrying idlers and return rollers on special stands which were linked together by rope up either side of the line of stands.

After these preliminary attempts it was not until a quarter of a century later that the next important developments came about, this time in the United States. In 1954, at Peabody Mine No. 17, the idea was conceived of using chain linked variable troughing idlers instead of the rigid idlers originally proposed, thus inventing the first true rope side-framed conveyor with its advantages of variable troughing and extra capacity. The basic outline of these ideas is given in American Patent 2773257.

This structure, manufactured by Goodman Manufacturing Co., was an immediate success, and by 1957 there were almost 300,000 ft. of Goodman rope side-framed conveyor structure in use in the mines of the U.S. Distington Engineering Co. Ltd., Workington, Cumberland, had been associates of Goodman in the mining field for many years, and at the end of 1955 it was decided to introduce the new structure to Britain.

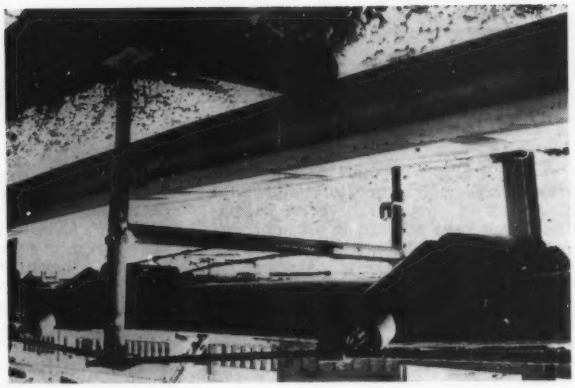
The points to note in the American-made product are:

(1) The 2½ in. dia. idler rollers;
(2) The height adjustment feature of the stands which enabled the ropes to be set at varying distances above the ground;
(3) The return roller set close to the ground and at a fixed height above the ground;
(4) The use of steel wedges to lock the idlers, stands, etc. to the ropes;
(5) The open nature of the structure with no deck plates for places for dust and dirt to lodge;
(6) The return belt in full view at all times.

Distington Modifications

After further modifications and improvements to the design Distington put the new conveyor structure into production in 1957 and first deliveries took place in mid 1958. This structure made use of 4 in. dia. rollers in place of the 2½ in. dia. rollers used by the Americans, and the stands were so designed that the underside of the return roller was 12 in. above the ground, while the adjustable height feature was made so that the return roller as well as the ropes could be properly levelled up on side sloping ground.

By 1958 Distington was at work on experiments with suspended structure. The next step was the invention of "dual purpose" structure in which the stands could be used either with telescopic feet for floor mounting or without feet for slinging and in which several ideas for the positioning and mounting of return rollers were tried out. By mid 1959 the "dual purpose" structure was in production.



Prototype of the dual purpose structure put into production by Distington in mid-1959

A development pioneered by the National Coal Board and Distington in Yorkshire late in 1958 was the use of stell props. These were wedged between the floor and the roof at an angle of about 10 deg. off vertical and the ropes were anchored to them in place of the customary main stands and floor bolts. These stell props had several advantages in that they were made by the colliery, thus reducing the price paid for the conveyor structure; they were not loosened by heaving floors; and made it possible to adjust the height of the rope.

Further Improvements

In 1960 there were several more significant improvements. As is well known the problem of training bad belts and maintaining belt alignment under severe floor and gradient conditions led first to the introduction of restrainers. These imposed certain limitations on stand design, and further research into the problem of belt training by giving a lead to the wing idlers led to trials of several ideas. The next important advance came with the invention of a new idler clamp in the form of a rigid fitting secured to the rope by a special heat treated bolt and so arranged to give the wing rollers of each idler set a backward cant of about 4 deg. in order to ensure belt centralisation and good alignment. This in turn made it feasible to remove the cross bar from the middle of the intermediate stand where previously it had provided an anchor point for belt training restrainer hooks, to a point below the return belt. Current plans call for the production of both designs of stand so that there is a choice between stands having a central cross bar and stands having a bottom cross bar, the former type of stand being the stronger while the latter permits supplies to be run inby where necessary.

While Distington-Goodman ropebelt rope side-framed conveyor structure is known and proved, it is still developing with the main emphasis being to improve quality at the same time as reducing costs. Further emphasis is being placed on the provision of suitable accessories such as side loading stations, a special loop take-up unit, anchorage fittings and others. The basic principles and advantages, however, remain the same.

Technical Briefs

Beneficiating North Carolina Spodumene—Beryl Ores

A recent report by the U.S. Bureau of Mines deals with laboratory and pilot plant tests of spodumene—beryl pegmatites which have resulted in an improved method for separating and recovering spodumene, mica and beryl. The method comprises soap flotation of the spodumene employing about 2 lbs. per ton of a lignin sulphonate and 2 lbs. per ton sodium fluoride instead of the more common process, pre-treatment with acid or caustic soda.

After conditioning with these reagents for five minutes, followed by further conditioning with oleic acid, the spodumene floats well and the beryl flotation is retarded. The mechanism is not fully understood but it seems likely that the fluoride complexes soluble salts. The pH value is not critical and flotation is good between 6.5 and 9.0.

Subsequently it is possible to float the mica in an acid circuit with coco-amine acetate and finally the beryl, after conditioning with hydro fluoric acid, removing the excess acid by suitable washing. Oleic acid was used as a collecting reagent for the beryl and the pH adjusted to 7.6 with sodium hydroxide.

The rougher concentrate requires two stages of cleaning and a 30 : 1 concentration ratio could be made. Furthermore, it is possible to separate felspar from the beryl tailing by the normal procedure using hydrofluoric acid conditioning and flotation using a cationic collector.

A modified procedure for the spodumene flotation is now being used commercially but the beryl recovery process has not been commercially adopted but the method is being studied in a large pilot plant. Certain desliming steps appear to be desirable, largely to remove some clay.

A bulk spodumene—beryl concentrate can also be treated in a similar manner. In one method, sulphuric acid conditioning was employed to remove the fatty acid coating, mica floated by an amine and the spodumene floated using lignin sulphonate and sodium fluoride.

When the tailing from this operation is treated with the hydrofluoric acid—fatty acid flotation technique, a good beryl concentrate can be made. Sodium sulphide can be used to replace the lignin sulphonate.

Tests involving magnetic and electrostatic separation, pneumatic tabling and ordinary wet gravity concentration were carried out but were not effective. On the other hand chemical leaching can be used to extract lithia from bulk beryl-spodumene concentrate and treatment consists of sulphuric acid leaching after decrepitation of the ore.

After the lithia has been removed the leach residue can be calcined with gypsum and the beryllium removed by leaching with dilute sulphuric acid when 90 per cent may be extracted.

CAUSTIC SULPHIDE LEACHING OF MERCURY PRODUCTS

The U.S. Bureau of Mines reports also that it has been demonstrated that cinnabar and meta cinnabar can be effectively dissolved from ores and concentrates with a solution of sodium sulphide and sodium hydroxide in a ratio of 3 : 1. More than 95 per cent of the cinnabar in a 5 per cent flotation concentrate could be recovered and from 60 per cent to 90 per cent in lower grade ores.

Mercury—arsenic products need a double treatment involving a potassium sulphide leach which removes over 90 per cent of the arsenic and one to ten per cent of the mercury whilst further treatment with sodium sulphide mixed with sodium hydroxide dissolves 80 per cent to 90 per cent of the remaining mercury and 5 to 10 per cent of the residual arsenic.

NEW ZINC PROCESS FROM RUSSIA

The Soviet State Institute for Non-Ferrous Metal Research is stated to have developed a new process for the electrolytic production of pure zinc which would allow the automation of zinc production, while doubling productivity.

The process is based on the passing through a zinc sulphate solution of an aluminium band, acting as cathode. Thin zinc foil is formed on this cathode and separated off continuously on to a drum. The necessary equipment is so constructed as to make impossible the escaping of unhealthy sulphurous vapours.

PRODUCTION OF ZIRCONIUM

Zirconium has come into prominence in the last decade because of its nuclear applications. The low neutron cross section and corrosion resistance of the metal have led to its extensive use as cladding for reactor fuel elements. One of the problems of industry is to develop an inexpensive and continuous process for producing pure zirconium. National Lead Co. originated the principle of ram-compacted sponge and have recently claimed success for their ram reactor development. The principle of ram-compacted sponge was investigated by the Bureau of Mines and developed as the semi-continuous reactor process. The process investigated by the Bureau involves the addition of sodium and zirconium tetrachloride through the side rather than the top of the reactor, and the billets from the semi-continuous reactor are heated in an evacuated furnace before use as consumable electrodes for arc melting. The purpose of the heating is to remove the bulk of the entrapped salt which, if left in, would cause problems in the conventional arc furnace.

The present Kroll method is a batch process which utilizes a combined purification and reduction of zirconium tetrachloride. Zirconium tetrachloride is reduced with magnesium in an inert atmosphere retort. The crucible, containing sponge and salt, is then inverted in a purification retort and heated to 960 deg. C. under vacuum to remove the salt by draining and distillation. The purified sponge is carefully removed from the crucible, graded, crushed, sorted to size, compacted, and fabricated into consumable electrodes for arc melting. This handling of sponge involves considerable hand labour and expense.

The semi-continuous reactor process developed by the U.S. Bureau of Mines is described by J. E. Mauser in *Report of Investigations, 5759*. The report describes a study of test variables such as reactor temperature and reductant charge weight, and evaluates the results such as billet metal hardness, residual billet salt content, and suitability of a purified billet as a consumable electrode for arc melting.

The process developed termed the semi-continuous reactor process produced billets of compacted zirconium sponge. The metal was produced by reducing zirconium tetrachloride with sodium and magnesium beneath molten by-product salt. Hydraulic rams at each end of a vertical reaction tube compacted the sponge and ejected it as a billet. These billets were purified by heat under vacuum to remove entrapped salt. The goal was to utilize the purified billet directly as a consumable electrode for arc melting.

It was concluded that the most satisfactory billets were produced at a temperature of 825 deg. C. The magnesium-produced billets contained as much as 83 per cent by weight of zirconium metal. The sodium and magnesium bimetal-produced billets contained as little as 0.62 per cent salt upon purification. A consumable electrode was melted directly from a compacted and purified billet, but the process was difficult. Improved production techniques led to a steady decrease in billet impurities, but intermittent operation resulted in high oxygen levels and consequent metal hardness (Rockwell A64). Continuous operation of the reactor was difficult because of weld failure, corrosion, and recurrent plugging of the lines by salt and reaction products. The lack of more suitable construction materials resulted in high maintenance costs.

PROPERTIES OF "TERYLENE"

The properties of "Terylene" and the part it plays as an industrial fibre, are described in a booklet which has recently been published by Imperial Chemical Industries Fibres Division. Filament yarns have a tensile strength of 80,000-123,000 lb. p.s.i., and under the strain of 70 per cent of its breaking load, high-tenacity "Terylene" extends only 6 per cent in length. When exposed to air at 150 deg. C. for 1,000 hours, its loss of strength is only 50 per cent, and it withstands temperatures up to 200 deg. C. for shorter periods.

Concepts of belt-conveying hitherto thought impracticable have been made possible by "Terylene", and its great flexibility enables belts to be troughed more deeply, eliminating the need for decking, side plates, etc., formerly used to prevent spillage. Used as lorry tarpaulins, it can stand up to the scuffing action of ropes, and provides adequate protection for dusty loads, such as

cement. "Terylene" fire hose has the advantage of being completely rotproof, and light and compact when rolled. "Terylene" polyester fibre has been officially graded as a Class E insulator, and has been used successfully for battery separator fabric. Its good resistance to most mineral and organic acids allows "Terylene" filter cloths to be used for the filtration of hot gases, and it has a wide use in the metal smelting industry. A further advantage is that the filter cloths can be cleaned with weak acids when necessary without detriment.

RARE EARTH—PALLADIUM CERMETS

The exceptionally high thermal neutron absorption cross sections of samarium, europium and gadolinium make these rare earth elements particularly suitable for use in control rods and for shielding purposes in nuclear engineering. Unfortunately no technique has yet been evolved for their economic fabrication into the necessary shapes, although much effort has been put into research on this problem, more particularly into the use of rare earth compounds dispersed in metal matrices.

An interesting attack on this problem has now been reported by E. S. Funston and J. A. McGurty of the Aircraft Nuclear Propulsion Department of the General Electric Co., U.S. It is described in *Platinum Metals Review*, Vol. 5, No. 2.

In the course of research aimed at the development of nuclear control or shielding alloys which could be used in air at high temperatures, studies were made on palladium base alloys containing neutron poisons such as samarium and gadolinium metal. In subjecting 5, 10, 15 and 20 weight per cent samarium in palladium to elevated temperature tests, it was found that these alloys possessed exceptional high temperature stability. It was found, however, that the stability of these alloys did not arise as a result of the oxidation resistance of the binary alloy system, but rather due to the fact that, when heated in air, oxygen very rapidly penetrated the alloy causing oxidation *in situ* of the samarium and forming a cermet.

One of the features of cermets produced by such a procedure is the uniformity of oxide dispersions within the metallic matrices. Also, cermets containing large amounts of oxide dispersion are severely limited as to their workability. Cermets made by internally oxidizing the rare earth metal allow for metal working or machining before the ceramic phase is formed. After the component is in final shape the oxidation process can be brought about in such a way as to produce a uniform dispersion of the ceramic phase throughout the metal matrix.

Obviously other rare earth metals may be substituted for the samarium constituent.

QUANTITATIVE SPECTROCHEMICAL ANALYSIS

A method for quantitative spectrochemical analysis by a powder d-c arc technique provides for the determination of those constituents in rocks, minerals, ores, and other materials that are amenable to spectrochemical analysis, especially where present in low concentration. Constituents present in high concentration are brought into the photometric range of the analytical curves by dilution techniques. The minimum concentration that can be determined for a given element is governed by the spectral sensitivity of this element in the d-c arc. For certain elements the spectral sensitivity can be extended to a lower concentration by using special techniques. Results are reported in weight per cent of the element. The method is reported in U.S. Geological Survey Bulletin 1084—G.

The general steps of procedure for this method follow the conventional d-c arc analysis of powdered material where graphite electrodes are used (Ahrens, 1954). Equal-weight parts of samples and standards are transferred into cupped electrodes of uniform dimensions and completely burned by using a d-c arc stabilized at a point near 16 amperes. The total-energy method (Slavin, 1938, 1939) is used. The relative transmittances of selected analytical lines are determined photometrically; these transmittances are converted to intensities through plate calibration by means of a set of homologous iron lines for which relative intensities have been established (Dieke and Crosswhite, 1943; Crosswhite 1950). Working curves for the elements are constructed from the spectra of a series of standards by plotting the logarithms of the intensities of the selected analytical lines with the logarithms of the concentrations of the elements in the corresponding standards. The concentrations of the elements in the samples are determined by referring the logarithms of the intensities of the lines in the spectra of the samples to the working curves.

Large rocks are crushed to about walnut-size in a commercial rock-crusher, put through a commercial roller mill, and reduced to about 8-mesh size. Mechanical grinders equipped with agate mortars and pestles reduce samples to fine powders of about 200-mesh size. Samples may also be reduced to 100-mesh size, without contamination, by a new high-alumina ceramic buckboard and muller (Bloom and Barnett, 1955)—the speed of grinding is faster than that of an agate mortar. Iron plates and tool-steel mortars are also used for reducing the particle size of some samples. Boron carbide mortars are used for samples requiring analysis for silicon. Precision balances are used in sample dilution and electrode-loading operations. Standard chemical laboratory equipment including an analytical balance, an electric furnace, a drying oven, porcelain and platinum crucibles, and chemical glassware are used when needed.

Auxiliary equipment for making mineral separations in preparing samples for the study of the distribution of the elements in geochemical processes include a petrographic microscope, a binocular microscope and an isodynamic separator. Other equipment can be used that takes advantage of a difference in physical property. The short wave-length ultra violet light of a mercury-arc lamp is useful in checking for the presence of fluorescent minerals, such as scheelite and zircon (Cannon and Murata, 1944). The visible light of such a lamp is valuable in identifying and separating certain rare earth minerals because of colour differences arising from the intense absorption band of neodymium in the yellow (Murata and Bastron, 1956).

A spectrograph having a reciprocal linear dispersion of 5 Angstrom units per millimetre is used in the region 2250 to 4750 A. A series of neutral quartz filters mounted in a self-contained unit controls the intensity of the light that reaches the slit of the spectrograph. A direct-current excitation source capable of maintaining a steady current of 16 amperes between the electrodes is used. Resistors in series control the current and are connected in such a way that a rapid change from low to high current can be made by means of a switch while the arc is burning.

Commercially available purified cupped graphite electrodes and graphite rods are used. Prior to the availability of the preformed electrodes, all electrodes were machined in the laboratory on a lathe employing a special cutting tool (Myers, 1951) or a specially designed commercial electrode cutter. The spectra are photographed on two 10 in. plates placed end to end, and record the region from 2250 to 4750 A. Kodak type III-0 plates (extra thin) are usually used for this purpose.

A non-recording projection microphotometer, incorporating a phototube, an amplifier, and a galvanometer, is used for measuring the optical density or transmittance of the analytical lines. Continuous scanning must be provided by such an instrument when line-width measurements are made.

Apparatus that permits the entire operation of developing, fixing, and washing spectrographic plates at a controlled constant temperature is used. Means for continuous agitation during the developing process are provided. Plates are dried on an electric drier equipped with an air circulator.

LABORATORY CONCENTRATION OF TITANIUM-BEARING ORES

The concentration of titanium from samples of titanium bearing deposits by gravity and flotation as well as the improvement of concentrate grade by means of magnetic and electrostatic separation has been recently investigated by the U.S. Bureau of Mines, using titanium bearing ores from the Pacific North West. Studies have also been made to determine the possibility of improving the separation and to upgrade the titanium content by methods other than physical beneficiation. They are reported in the Bureau *Report of Investigations*, 5771.

The concentration was shown to be mainly dependent on the physical nature of the mineral constituents and concentrates containing 30 to 40 per cent TiO_2 were possible in most cases but recovery ranged from 20 per cent to 70 per cent depending on the particle size of the mineral and degree of interlocking.

Wet gravity methods were most effective for dealing with ilmenite when the particles were plus 200-mesh and flotation was most effective when the ilmenite was finer than 200 mesh and particularly when associated with clay.

Chlorination tests were shown to be effective for removing titanium from sphene concentrate when over 85 per cent could be extracted at 800 deg. C., in tests using a one inch tube furnace. Attempts to remove iron from the ilmenite crystal lattice by suphurization were ineffective and the use of a reducing roast to recover ilmenite from ferrugineous bauxite after the iron and aluminium had been removed were also unsuccessful.

MINING MISCELLANY

A number of new iron ore mines are to be opened in Finland in addition to those already in operation at Otanmaki and Karvasvara, which together produce some 900,000 tonnes of ore annually. These are at Rajarvi, near Karvasvara, and at an as yet unspecified point in the extreme south of Finland. The Rajarvi mine will produce between 300,000 and 400,000 tonnes annually and the other some 200,000 tonnes of a low-grade ore. It is further planned to sink a mine at Kolari, near the Swedish border, where a large deposit of rather lean but economically exploitable ore has been located. Other future plans in the Finnish mining industry include the opening at Korsnas of a mine with an annual production of 1,000,000 tonnes of lead ore and a continuation of studies into the chrome ore deposits found in Finland in 1959.

★

Gunnex Ltd., a wholly-owned subsidiary of Gunnar Mines, the Canadian uranium producer, and Lehman Bros. of New York, have entered into an agreement with five exploration companies for the investigation of some 85,000 acres in Nova Scotia along what is known as the Windsor-Horton contact, a structure regarded as favourable for the repetition of silver-lead orebodies. Approximately 66,000 acres will be explored by Gunnex during a two-year period with funds supplied by Gunnar and Lehman Bros. The remaining 19,000 acres will be retained and explored directly by the other five companies concerned in the agreement. According to *The Northern Miner*, this could develop into a major programme. Attention has been attracted to this area by Magnet Cove Barium Corp.'s recent discovery of a rich silver-lead orebody. Magnet Cove's new mine is expected to come into production in a few months.

★

Iron ore exports by the Orinoco Mining Co., of Venezuela during the first half of 1961 totalled 6,970,000 tons, compared with 8,480,000 tons in the same period of 1960.

★

Western Mining Corporation of Australia plans to spend £A2,250,000 on exploration and exploitation of the Tallering Peak iron ore deposits, about 100 miles from the port of Geraldton. The company will have to construct a railway for transport of ore, for shipment to Japan. An agreement, signed between the State Government and the company for a period of five years, enables the company to mine 2,000,000 tons of ore initially, on payment of a royalty of 6s. per ton of ore exported from the field. Cost of railway and equipment will be about £A1,200,000, and additional cost for shipping facilities about £A200,000. At the end of the term of the agreement, the railway and rolling stock will become the property of the government. In addition, Western Mining will pay rail freight on ore from mine to port, and wharfage charges on export.

★

The Canadian government is undertaking a national programme of magnetometer survey for the whole of the Precambrian area known as the Great Laurentian Shield in Northern Canada. The survey, which will take several years to complete, will be put out to private companies on a contract basis.

A site in Lexington Park, Mass., has been purchased by Kennecott Copper Corpn., for its new Basic Research Laboratory, where a programme on the solid state physics of metals will be undertaken. The company has already instituted research programmes for improving the recovery of copper and other metals, the quality of fabricated products and new developments, which are undertaken in their research centre at Salt Lake City, and at the fabricating subsidiaries, Chase Brass and Copper Co., Waterbury, Conn., and the Okonite Company, N.J.

★

The American-Israel Phosphate Co., founded by Albumina Supply, of New York, is to develop phosphate deposits in the Negev, Israel, where it holds licences, including one reserve of 50,000,000 tons of phosphate rock at Hameshar. The company hopes to be able to export 600,000 tons annually in two or three years, rising eventually to 1,000,000 tons, and plans a flotation plant capable of producing enriched phosphate rock of 32-34 per cent P_2O_2. An expenditure of $10,000,000 is planned.

★

A Canadian steel producer, Premier Steel Mills, is reported to be investigating the feasibility of pumping powdered iron through a pipeline from the Peace River district, northwestern Alberta, to ports 400 miles away on the Pacific Coast, where the powder would be turned into iron for export. The source of the powdered iron would be Hines Creek, which is reported to contain 230,000,000 tons averaging 34-36 per cent iron.

★

AEI has been awarded a £171,000 contract for supply and installation of cables and accessories for two 200 megawatt generating sets at Kincardine 'B' power station for the South of Scotland Electricity Board.

★

Mr. Kurdas, Turkey's Minister of Finance, has stated that of the $234,000,000 required for the construction and equipping of the Eregli Iron and Steel Works, $168,600,000 is to be used for buying materials and equipment from abroad and the rest will be spent locally. Some $34,000,000 is being provided by the State sector and $10,000,000 by the Turkish private sector. Initially, production at Eregli will be of the order of 430,000 tonnes of raw products and it will rise finally to 1,000,000 tonnes a year.

★

The mines of the New Abbeytown Mining Co. Ltd., of Ballisodare, County Sligo, closed down on September 13 because of exhaustion of the known ore reserve. These mines had been exporting an average of 400 tons of lead and zinc concentrates monthly to Antwerp throughout the past 11 years. A diamond drilling programme failed to find any extension of the ore bed.

★

Geophysical engineers of The ABEM Co., of Stockholm have recently started a geophysical exploration programme to the south and east of Kiruna town centre, as the first stage of a survey of the whole Kiruna ore field.

It has been officially stated that coal has been reached in the central tunnel of the Makerwal collieries owned and operated by the Pakistan Industrial Development Corporation, at a depth of 5,116 ft. The boring of the tunnel is to be continued as part of the general scheme of development of the P.I.D.C.'s collieries. This scheme, costing Rs. 16,700,000, is expected to increase the output of the collieries from 500 to 1,000 t.p.d.

★

Kaiser Aluminium has signed an agreement with the Government of Panama to explore the Chiriqui Province for bauxite deposits. A survey of the country's hydraulic and mineral resources is to be financed by the U.N. Special Fund.

★

Hindustan Steel Ltd. has signed a contract with Koppers of Essen, West Germany, for the supply and construction of an iron ore sintering plant at the Rourkela Steel Works. The value of the contract is Rs. 40,000,000. The plant, which is to be set up by Koppers of Essen in collaboration with Koppers Co. Inc., Pittsburg, U.S., will have a daily capacity of 4,000 tons of blast furnace sinters and will be completed in two years. It will enable utilization of fine-grained ores, which otherwise would go to waste. A large part of the structure and installations needed for the sintering plant will be made in India. Indian firms are also likely to be entrusted with civil engineering and construction works.

★

A scheme for substantial iron ore export through the port of Paradip is being finalized by the Orissa government. Involving a capital outlay of Rs. 280,000,000 during the first three years of the Plan period, it envisages exploitation of the Daitari iron deposits in Cuttack district through a mining corporation, with rapid transport of ore from the mines to Paradip. The port will be developed for exporting 5,000,000 tons of ore annually by 1967-68. As the scheme expands, it is proposed to produce pig iron and semis for export in place of ore. By the end of the Third Plan the scheme is expected to earn foreign exchange of more than Rs. 200,000,000 a year.

★

Conditions in the Austrian mining industry remained generally favourable in the first half of 1961, but in some sectors a declining tendency was noted. It was due in copper mining to a shortage of labour, in lead-zinc ore mining to unfavourable world market conditions, and in general to increasing competition from abroad and a certain saturation of the domestic market. Lead-zinc ore production decreased by 23.6 per cent to 107,100 tonnes, copper ore production by 9.7 per cent to 63,900 tonnes, and bauxite production by 29.4 per cent to 8,300 tonnes. On the other hand, output of raw magnesite rose by 7.1 per cent to 868,200 tonnes and that of wolfram ore by 32 per cent to 4,300 tonnes.

★

A diamond drill hole is to be put down by the Mines Department to test nickel deposits at Beaconsfield, Tasmania, to a depth of at least 250 ft. These deposits have been known for some years but so far work has been confined to the surface and to some shallow boring.

The Swedish mining company, Boliden Gruvaktiebolag of Stockholm, has created a subsidiary in Paris, known as Boliden France S.A., for the sale of its non-ferrous metals.

★

According to the Bank of London and South America, iron ore deposits at San Isidro, Las Pailas and San Joaquin are reported by the Venezuelan Minister of Mines to total 600,000,000 tonnes with an average iron content of 63 per cent. A study is to be made of the Las Barrancas deposits, which are estimated to contain between 400,000,000 and 500,000,000 tonnes of ore.

★

The Hon. James A. Maloney, Minister of Mines, has announced that a 50 per cent increase in the rate of geological mapping is to take place in Ontario next year. The Department plans to step up the number of field parties in the Kirkland-Timmins-Cobalt area from three to seven. Assistance has been offered by the Federal Department of Mines and Technical Surveys in a programme for the location of new ore-bodies within the general area. The Kirkland Lake situation has become critical from the aspect of declining employment and production.

★

A report by Barclays Bank D.C.O. states that a £7,000,000 development programme is planned in Sierra Leone, which will improve the port facilities at Pepel and allow major increases in the iron ore milling capacity at Marampa. This new project will increase the output of Marampa by about 50 per cent. A new ship-loading berth at Pepel is to be built for the accommodation of large ore carriers and the stocking capacity for oil is also to be increased.

★

A new company, to be called the Irish Barium Co. Ltd., has been set up in Eire to operate the old barytes mines at Derryginnough, near Bantry, in County Cork. These mines were last worked 40 years ago.

★

Barclays Bank D.C.O. reports that a new factory has been opened in Salisbury by Rhodesian Diamond and Carbide Products Ltd., to produce tungsten carbide drill rods. detachable bits. coal picks and borers and all types of tungsten carbide tools and diamond crowns for the mining industry.

★

Recent investigations by the Indian Bureau of Mines on the technical and economic aspects of utilizing the pyrites deposits of Amjore, in Bihar, for the production of sulphuric acid, are reported in *Research and Industry*, a monthly periodical published by the Council of Scientific and Industrial Research. In India, almost all sulphuric acid production is based on elemental sulphur, which is imported. It is estimated that by 1965-66, requirements of imported sulphur for this purpose would reach 400,000 t.p.a Projects which could reduce this dependence on imports are thus of considerable importance. The Amjore pyrites deposits are the most promising indigenous source of sulphur, reserves being estimated at about 384,000,000 tons of sulphide ore over an area of 48 sq. miles. Of these about 78,000,000 tons are proved reserves averaging 40 per cent sulphur.

The entire gold output of the Kolar and Hutti Mines since July, 1958, has been acquired by the Central Government, said Mr. Morarji Desai, India's Finance Minister, in Parliament. During the two years 1959-60 and 1960-61, the government acquired 5,280,000 and 4,950,000 grammes of gold respectively from these mines. A sum of Rs. 75,200,000 was paid as a grant-in-aid to the Government of Mysore during the three years from 1958-59 to 1960-61 on the purchase of gold from Kolar and Hutti.

★

The Swedish Board of Trade has given its approval for mining operations to start at the Stekenjokk ore fields in the Vilhelmina commune in Lapland. Preliminary work has already begun. Extensive diamond drilling by the Geological Survey has shown that Stekenjokk ore contains some 11,000,000 tons of copper-zinc ores with an average content of 1.6 per cent copper and 3.2 per cent zinc.

★

The start of next year is now given as the opening date of a new ferrochrome plant being erected on the south coast of Turkey. The plant is a joint venture of the French firm Péchiney and the Eti Bank.

★

A group of scientists sent to Peru by the Federal German government has completed uranium exploration in the Vilcabamba region. A number of ore samples have been taken to Germany for further examination

Conveyor belt made by Barrow, Hepburn & Gale from a 4-ply "Terylene"/cotton fabric, for the Midland Gravel Co. in use at Packington Quarry, near Coleshill. This belt, of 2,500 ft. centres, replaces three cotton belts, is capable of carrying 200 tons of sand and gravel per hour, and is one of the largest field conveyors in the U.K.

Coming Events

The 2nd Chemical and Petroleum Engineering Exhibition will take place at Olympia, London, from June 20-30, 1962. Under the joint sponsorship of the British Chemical Plant Manufacturers Association and the Council of British Manufacturers of Petroleum Equipment, between 400 and 500 exhibitors will occupy some 240,000 sq. ft. of space in Olympia's three main halls and their galleries. A lecture theatre to accomodate 1,000 people will be built on the first floor of the Empire Hall, where the 3rd Congress of the European Federation of Chemical Engineering will be held during the course of the exhibition with symposia on "Process Optimization", "Interaction between Fluids and Particles", the "Handling of Solids" and the "Physics and Chemistry of High Pressures". The 4th Congress of the Federation of European Petroleum Equipment Manufacturers will be held from June 25-28 at Church Hall, Westminster. About 20 technical papers covering automation, new corrosion resistant materials, temperature insulation, aircraft refuelling and future trends in the design of drilling equipment for the petroleum industry will be presented.

★

The second Effluent and Water Treatment Exhibition and Convention will be held at the Seymour Hall, London, October 31-November 3 when papers will be presented covering internationally the subjects of Effluent and Water Treatment. Registrations for the convention have been accepted from French, Belgian, German, American, Italian as well as British delegates. Registration is £4 per delegate and forms are obtainable from the organizers: Thunderbird Enterprises, London.

★

The Conference Internationale des Arts Chimiques will be held in Paris, in the Maison de la Chimie, from April 25 to May 4, 1962. Arrangements are now being made for special registrations to attend the European Meetings on Chemical Engineering and on Corrosion, and the "Journees Techniques de Paris".

★

The Fifth International Conference on Coal Science, will be the first to take place in the United Kingdom in 1963. The conference, which meets every two years, is to be held at the town hall in Cheltenham, Glos., from May 28-30, 1963.

★

The Institute and Society on behalf of the International Union of Pure and Applied Physics, and the British National Committee for Physics is arranging an International Conference on the Physics of Semi-conductors, which will be held at the University of Exeter from July 16-20, 1962. Accommodation will be provided in halls of residence at the University. Further information regarding the Conference may be obtained from the Administration Assistant, The Institute of Physics and The Physical Society.

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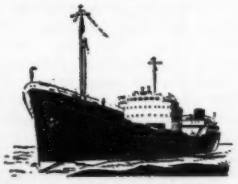

BROKER MEMBERS OF THE BALTIC AND INTERNATIONAL MARITIME CONFERENCE

Metals and Minerals

Optimism in the U.S. Aluminium Industry

In contrast to the position in the U.K., where recent consumption figures have been disappointing, aluminium producers in the U.S. are becoming increasingly convinced that a wave of further expansion lies immediately ahead. Although U.S. aluminium shipments in the first half of 1961 were 4 per cent lower than in the corresponding period of 1960, they have recovered sharply and are now running at an annual rate which probably exceeds 2,500,000 tons. It is now expected that the year's shipments will reach 2,450,000 tons, which would be 4 per cent higher than the total for 1960 and almost up to the 1959 record of 2,480,000 tons.

Speaking at the American Mining Congress, Mr. Walter L. Rice, president of the Reynolds Mining Corp., expressed the view that, despite its current idle capacity of 500,000 tons, the U.S. aluminium industry could enter a boom period sooner than anyone had the temerity to predict.

One reason for confidence is the belief that the new defence build-up will provide an additional market for millions of pounds of aluminium during the current fiscal year. According to Mr. George Bailey, manager of the Federal Sales Division of Reynolds Metals, early military acceptance of new lightweight equipment now in the prototype or development stage could increase present estimates even further. The new emphasis on mobility of men and equipment makes lightweight equipment mandatory, said Mr. Bailey, resulting in extensive use of aluminium. Additional aluminium procurement by military agencies should begin to be felt late this year and should be strongly manifested early in 1962.

Reynolds Metals recently announced plans for further expansion of its reduction plant at Longview, Washington. The company plans to install two more holding furnaces and a vertical casting machine which will produce 5,000 lb. ingots. The new equipment will be incorporated in the existing casting shop, which has just been extended by a $700,000 addition comprising three new furnaces, a horizontal casting machine, sawing equipment, and aluminium homogenizing facilities.

New uses for aluminium continue to be announced, among the latest being an aluminium underground pipeline system for connecting gas mains to home lines, which is claimed to be less expensive to install than anything now available. The aluminium pipe is fabricated in continuous 300-ft. coils or longer, thus eliminating the need for intermediate joints. The exterior is protected against corrosion by vinyl-butyl rubber laminate, together with inexpensive insulation. As an added advantage, the smooth interior of the aluminium pipe increases flow efficiency by over 8 per cent as compared to steel pipe. This new application for aluminium is seen as opening up a market with an annual potential of about 15,000 s.tons.

Reynolds Metal have also announced a process whereby aluminium sheet and foil can be permanently vulcanized on to rubber, yielding a material combining the surface toughness, corrosion resistance and insulative values of aluminium with the flexibility of rubber.

★

The United States output and import of bauxite during the second quarter of 1961 showed no significant change over the first quarter but the total new supply of the ore was 12 per cent lower during the first half of this year than it was during the corresponding period of 1960, according to the U.S. Bureau of Mines.

★

A 110,000,000 new franc loan to develop the French aluminium industry has been floated in Paris. The loan is issued by the investment company Petrofigaz on behalf of Péchiney and Ugine, the two French aluminium producers.

WOLFRAM ORE PRICE FALLS

The wolfram ore shipment price has been steady after its reduction last week by 1s. 6d. making the new range 124s. 6d. to 127s. 6d. per long ton unit c.i.f. Europe for minimum 65 per cent material. Dealers reported a moderate business being done at 124s. 6d. and 126s.

U.S. BARTER OFFER

The U.S. Agriculture Department has announced that it will consider offers to barter beryllium metal and oxygen-free high conductivity copper for agricultural commodities. The metals thus obtained would eventually be transferred to the Government's stockpile of strategic materials.

QUICKSILVER ON THE FLOOR?

The current price of quicksilver in the U.S. is $188-$191 and the present weakness of the market is measured by comparing this level with the average level of $210.75 during 1960, itself a disappointing year. It is hardly surprising therefore, that operations in the Sonoma quicksilver mine at Greenville, California, should have ceased. Demand for the metal in the U.S. has, in fact, been exceptionally low throughout most of 1961 which has inevitably led to large quantities being diverted to the U.K. market. In turn, rising imports into this country unmatched by any comparable increase in demand have resulted in a steady fall in the London price.

Most dealers are now indicating £62 per flask ex-warehouse compared with £63 previously. The latest fall of £1 has been the eighth successive downward movement this year and the current London price is £4 cheaper than it was last June when the price fell to its lowest level for seven years.

Russian quicksilver, which first entered the London market in the autumn of 1960, continues to figure prominently in British imports. Out of a total of some 2,254 flasks in July, Russian imports accounted for 1,148 flasks, the biggest monthly total from that country so far. Since November 1960 just over 5,000 flasks of Russian quicksilver have been imported by Britain although a considerable amount of this has nevertheless been re-exported.

July imports from Spain totalled 250 flasks, unchanged on the June figure, but

LONDON METAL AND ORE PRICES, SEPT. 21, 1961

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £230 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 11s. 0d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 250s. 2½d.
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram
Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £660 per ton
Osmium, £17/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £27 7s. 6d./£27 17s. 6d.
Quicksilver, £62 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79½d. f. oz. spot and 80½d. f'd.
Tellurium, 37s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	30s. 0d./33s. 0d. per unit c.i.f.
Beryl (min. 10 per cent BeO)	270s./275s. per l. ton unit BeO
Bismuth	30% 5s. 0d. lb. c.i.f.
	20% 3s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
„ Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
„ Refractory 40%	£11 0s. 0d. per ton c.i.f.
„ Smalls 44% (Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Pakistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10:1) $Nb_2O_5 : Ta_2O_5$	150s./160s. 0d. per l. ton c.i.f.
Lithium Ore—	
Petalite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O	76s. 0d./80s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	75s. 0d./85s. 0d. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%-48%) basis 60s. 0d freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	10s. 0d. per lb. (f.o.b.)
Titanium Ore—	
Rutile Australian 95/97% TiO_2 (prompt delivery)	£25/£25 10s. per ton c.i.f.
Ilmenite Malayan 50/52% TiO_2	£11 10s. per ton c.i.f.
Ilmenite Travancore 58/60% TiO_2	£15/£15 10s. per ton c.i.f.
Wolfram and Scheelite (65%)	124s. 6d./127s. 6d. per unit c.i.f.
Vanadium—	
Fused oxide 95% V_2O_5	7s. 6d./8s. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16 ton c.i.f.

no supplies came from Italy in July against 1,501 flasks in the previous month. Most of the major British consumers of quicksilver have long-term contracts with their principal suppliers, notably Spain and Italy, and while the Russians have obtained a useful foothold in the London market with their cheaper supplies other new suppliers are likely to find themselves competing for a restricted volume of orders.

In recent weeks the Chinese have been putting out market feelers and while their offers seem to be attractive, and some transactions at any rate have been arranged, London is not going to be an easy market for them. For one thing the Chinese do not pack the metal in standard flasks which complicates ordering, and secondly, re-exports to the U.S. of British supplies containing Chinese metal are likely to be refused entry.

Sentiment in the London market inclines to the belief that the price of quicksilver will not fall to much lower levels and certainly not below £61 per flask. This view is primarily based on an expectation of a revival of American demand because of a general economic recovery, and in particular under the stimulus of increased expenditure by the U.S. authorities on defence projects. In these circumstances the diversion of normal supplies from the U.S. to the U.K. can be expected to ease off with consequent buoyancy in markets on both sides of the Atlantic, rather more so perhaps in London.

TURKISH CHROME ORE FOR GERMANY

Chrome exporters in Istanbul state that the Eti Bank (the holding company for the nationalized sector of the Turkish mining industry) has started negotiations with W. Germany with a view to substantial chrome ore exports. Should the deal materialize, it would be the first Turkish chrome ore shipment to W. Germany in the post-war period, according to trade sources.

"MAGNESIUM IN FOCUS"

The general theme of the Magnesium Association's annual meeting, scheduled to take place in New York City on October 16-18, will be "Magnesium in Focus". Associated with it will be an exhibit entitled "101 Commercial Uses of Magnesium". Both the meeting and the extensive exhibit are intended to stress the promotional and educational programme which has been inaugurated to acquaint industry with the many ways in which magnesium is applicable com-

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mercially. Until quite recently, magnesium has tended to be associated with military and defence uses without being sufficiently recognized as a material highly suitable for structural and other civilian applications. Too great stress, it is also contended, has been laid on its lightness and not enough on other important features and structural uses which have now come to be appreciated in the automotive and materials handling industries.

NICKEL RESEARCH CENTRE

International Nickel Co., Inc. the U.S. subsidiary of International Nickel Co. of Canada, Ltd., plans to build a new metallurgical research centre in Sterling Forest, Orange County, N.Y., a 20,000-acre research park under development by a property company near New York. International Nickel has agreed to purchase 150 acres in the park where it will put up a facility for 300 people, to which research and development activities will be transferred from the company's existing laboratories in Bayonne, N.J.

COLUMBIUM FOR SPACECRAFT

Two new columbium base alloys have been developed for use in spacecraft and missiles, states a recent announcement, and are commercially available at the Du Pont Metal Centre in Baltimore. They were developed to solve problems relating to manned space vehicles which can re-enter the earth's atmosphere at high speed and can be landed as conventional aircraft. According to Du Pont, there is a growing demand for materials able to withstand friction-heat up to 2,700 deg. F., such as is associated with re-entry, and which are also easy to fabricate by conventional methods. The two new alloys are known as D-14 (a binary alloy containing zirconium) and D-36 (a ternary containing titanium and zirconium). They retain useful strength at temperatures above 2,500 deg. F. and can be readily fabricated, welded and coated by normal methods.

AUSTRIAN MAGNESITE

Both production and exports of the Austrian magnesite industry increased substantially in the first half of 1961, reflecting favourable conditions in European industry. Production of raw magnesite rose by 7.1 per cent to 868,200 tonnes and that of sinter magnesite by 8.1 per cent to 257,600 tonnes. Highly industrialized countries with a well developed iron and steel industry were the main importers of Austrian magnesite, the largest buyer being Western Germany. Expansion plans in the magnesite industry are well under way and investments continue.

INDIAN MANGANESE

There has been a sizable decline in India's exports of manganese ore during the first half of this year compared with the corresponding period of last year. As against 595,800 tons of ore valued at Rs 71,070,000 exported in January-June 1960, exports in 1961 first half have sagged to 510,400 tons valued at Rs 55,570,000.

The largest buyer was Japan with an offtake of 150,980 metric tons valued at Rs 11,990,000. The United States was the second largest importer and the U.K. third.

Copper · Tin · Lead · Zinc

(From Our London Metal Exchange Correspondent)

Whilst the prices of copper and tin have fallen since last week, the prices of lead and zinc have remained relatively steady. Stocks in U.K. official warehouses at the beginning of the week were higher in the case of copper and lower in the case tin, lead and zinc.

COPPER TEMPORARILY WEAK

Copper stocks in U.K. official warehouses rose by 200 tons to 22,084 tons, which is higher than for many years. On the L.M.E. the contango on this metal has widened to £4-£4 10s. and prices have fallen by £5 10s. for cash and £4 10s. for three months' metal; this is in spite of a known loss in production estimated at about 65,000 tons due to recent strikes. The announcement by the Japanese government of increases in the amounts which importers must deposit with the Bank of Japan on import shipments (35 per cent in the case of copper), the Chilean strike's suspension, the credit squeeze and the general lack of demand, have all contributed to the lowering of prices. Also it must be borne in mind that world smelter production is probably still in excess of consumption and stocks held by producers and manufacturers still good. In these conditions it is unlikely that prices will rise appreciatively in the immediate future but the position could, of course, change quickly if there is evidence of increased demand or curtailment of production due to labour difficulties or other troubles.

The Copper Institute's figures for August, with the July figures in parentheses (in s.tons) were :—

In U.S.A.		
Refined Production	143,967	(128,447)
Domestic deliveries	121,484	(113,444)
End of month stocks	95,177	(82,843)
Outside U.S.A.		
Refined Production	144,250	(175,746)
Deliveries	169,142	(170,104)
End of month stocks	329,735	(342,495)

The U.S. figures were disappointing to American operators, as it had been expected that they would show a decline of up to 30,000 tons for the month. In fact, the U.S. figures are extremely disappointing and it is hard to find any reason for Phelps Dodge's return to full production.

Outside the U.S. the picture is no worse than might be expected, as the loss in production is accounted for by the Chilean strikes. If this had not taken place the end of month stocks would have been up less than 20,000 tons, which for the month of August is not unexpected. The U.S. smelters intake price for No. 2 Scrap has been reduced to 25¼ c. per lb.

FURTHER FALL IN TIN PRICE

Tin stocks in U.K. official warehouses fell by 10 tons to 5,516 tons, whilst prices have fallen during the week by about £9 for nearby and £7 for forward metal. The contango has widened further and is now £12-£14.

In Singapore a welcome has been given to American assurances that the governments of producing countries would be consulted on the proposed sale from the national stockpile. At the same time Indonesia plans to raise the question of American policy at the forthcoming Tin Council meeting, which is scheduled for October 9. This follows the request to Congress to waive the usual six months' waiting period for the release of 10,000 tons, which Indonesia considers to be out of line with normal practice and against the interests of producers. Well informed quarters in New York are of the opinion that nothing will be done about this 10,000 tons during the present session of Congress.

Amongst figures issued by the Tin Council were those for the production of tin in concentrates in Malaya, which rose from 4,807 tons in June to 5,170 tons in July. Bolivian production in June fell to 1,224 tons from the May figure of 1,786 tons. Stocks of tin in concentrates in Malaya, Singapore and Bolivia were all lower at the end of June than at the end of May, and stocks in the U.K. were lower at the end of July than at the end of June. Consumption of tin in Germany during the second quarter of the present year totalled 11,058 tons as compared with only 8,992 tons in the first quarter.

On Thursday the Eastern price was equivalent to £959⅜ per ton c.i.f. Europe.

LEAD REMAINS QUIET

Lead stocks in U.K. official warehouses fell by 200 tons to 10,683 tons. Over the week prices have fallen slightly, whilst the contango has remained steady. Demand appears to be better on the Continent than in the U.K., but in general there appears to be nothing at present to influence prices one way or the other.

U.S. STRIKE PEGS ZINC PRICE

Zinc stocks in U.K. official warehouses fell by 171 tons to 6,903 tons. The contango on this metal has more than halved itself whilst there has been some day-to-day fluctuation in prices, cash on the week being 12s. 6d. higher but with no change in the three months quotation. Continuation of the strike at General Motors in the U.S.A. has helped to keep prices at a comparatively low level.

OFFICIAL TURNOVERS

Official turnovers (in l.tons) for the week ending September 15, 1961, with the previous week's figures in parentheses, are :—

Copper	11,325	(14,150)
Tin	1,850	(2,815)
Lead	10,450	(7,100)
Zinc	12,400	(7,525)

Closing prices are as follows :

	September 14		September 21	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£231¾	£232	£227½	£228
Three months ..	£235	£235¼	£231½	£232
Settlement ..	£232		£228	
LEAD				
Current ½ month	£64½	£64½	£64	£64¼
Three months ..	£66	£66¼	£65¼	£65½
TIN				
Cash	£945	£946	£938½	£939
Three months ..	£955	£956	£951	£952
Settlement ..	£946		£939	
ZINC				
Current ½ month	£72¾	£72⅞	£74⅛	£74⅛
Three months ..	£73⅛	£73⅜	£74⅜	£74⅜

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Mining Finance

Public Relations is no Luxury

Today, public relations has become a science and has reached the point of having specialists but, as with any problem, it is only when the treatment has reached an advanced stage that expert advice is necessary. Up to that point common sense must lead the way. Most mining companies and, for that matter industrial companies, are undoubtedly at this stage in their public relations, the experts are not yet necessary. All that is required is for the directors to compile their reports, not only as a legal requirement and a formality, but as a live report to shareholders who are interested. It is difficult to believe, but there are many companies where it is not possible from the annual reports even to discover where the mine is operating. Undoubtedly it was recorded in the prospectus, in say 1905, but the normal shareholder or investment manager who bought his shares six months ago and has just received his first annual report is certainly not going to hunt for a prospectus. Important information about the companies' operations should be repeated from year to year. So often one has to explore through four or five years' annual reports to even find a reference to the life of the property.

When people purchase shares in an operating company they are buying an interest in a living organism, the affairs of which vitally affect their investment and one would expect them to take an active interest. In fact, as a rule they take little more interest in the investment than if it were a post office savings account, preferring to use only the ultimate sanction of selling their shares on the stock exchange if they believe things to be going wrong. Apart from the one or two outstanding exceptions, most of which are amongst the South African gold producers, the fault lies with the operating company, not with the shareholder.

How can an interest be taken in the company's activities when the only information that is received arrives once a year with the balance sheet and profit and loss account, and then under the heading operations one is faced with a list of comments such as; "the dredge operated satisfactorily throughout the year"; "All plant and machinery has been kept in a good state of repair"; "Development has continued satisfactorily". Such uninspiring comments are surely more applicable to an obituary notice than a report on an active company. Not only are the comments themselves "dead" but also the report in which they appear seldom even looks as if it might be interesting, and thus many shareholders no longer even trouble to open it but simply look for a comment in the daily press (and with only the same information to use, their comments cannot be very helpful!.)

The more a shareholder knows of the operations of "his" company the greater will be the support, both directly and indirectly, that he will be able to give the directors. So many of the violent fluctuations in the mining markets are basically due to ignorance, such that rumour can play an ugly part. The more the individual investors and portfolio managers are interested and knowledgeable about the operations of the various companies so the impact of the minor setbacks that are bound to occur will be reduced. With a more stable market the climate for new issues and rights issues will also be far better and whilst it may appear to some that the likelihood of requiring new money at the present is remote in the long term capital funds will be required—even in the tin mining section.

Public relations is not a gimmick or a stunt, it is a tool of responsible mangement and if used judiciously it can cure the apparently chronic lethargy of the ordinary shareholder to the benefit of both the individual company and the mining industry as a whole.

London Market Highlights

There has been very little response to the Kaffir dividend season on the London market. Before the declarations. F. S. Geduld hardened a little and Ofsits also improved but with the announcements themselves both returned to their earlier levels and Western Holdings also eased by 7½d. to 116s. 10½d. St. Helena improved 1s. 3d. to 58s. 1½d. and this together with Harmony is one of the few gains that have been held. Harmony has moved from 21s. 6d. to 22s. 3d., this being a reflection of the news of the tax-free distribution, rather than the announcement of the maintained dividend.

These movements in the Kaffir section have all taken place in a very narrow market. In fact, on Wednesday the number of bargains marked fell to below 100, the lowest for a very long time.

Rhodesian coppers have remained continually under the shadow of the troubles, only a matter of miles away, in the Katanga. At the close of last week most of the prices were slightly easier though Union Minière held £9 10s. and Tanks improved 1s. to 19s. 9d. This was in response to a Continental demand which appears to have been mainly technical, a bear-closing operation which found London short of stock. At the opening this week a few buyers appeared in the Rhodesian section and, with the sensitive conditions that have prevailed here for some time past, small gains appeared.

However, with the tragic news of Mr. Dag Hammarskjöld's death in the air crash near Ndola, most sections of the market turned easier and this was particularly marked with the Rhodesians where most of the earlier gains were lost. Paris was also easier selling both Chartered and Nchanga and with the overnight fall on Wall Street the movement was accentuated. Buying orders have now started to appear again, mainly from Salisbury, S.R., and there are signs of a firmer tendency in the market. Over the full week the section as a whole has made slight gains, the leaders are Rhokana, up by 1s. 3d. to 44s. and Nchanga up by 9d. to 45s. 6d. Chartered have only lost 3d. in going ex-dividend, whilst Rhodesian Anglo American have gained 9d. to 54s.

Throughout the week Singapore has given the tin section no direct lead being variously both buyers and sellers and thus the market has tended to be unduly influenced by technical considerations in London. A set back occurred at the close of last week when a fair amount of end-Account selling made its impact. The steadying of the metal price after its recent fluctuations encouraged the return of a certain confidence to the market but overall it has been a week of losses. Amongst the leaders the falls have been about 5 per cent, Sungei Besi have lost 2s. 6d. to 41s. 6d., Ayer Hitam 3s. 6d. to 46s. 6d. and Gopeng by the same amount to 39s. 6d. British Tin Investments has been one of the few to move against this trend and has gained 9d. to 18s. 6d., London Tin have not shown a gain but after making an allowance for having been marked ex the one-for-five scrip issue have lost very little.

Under Australian influences Broken Hill South, Western Mining and Broken Hill North have all shown gains. Broken Hill South have risen to 14s. 10½d., a new high for the year, and Western Mining have gained 9d. to 19s. 6d.

AUTUMN DIVIDEND SEASON

The "little season" of Kaffir dividends started well, as discussed in these columns last week, with the increased payment from the Union Corporation mines. Now the dividends of the O.F.S. Anglo American mines have been declared and the highlight is the declaration by Western Holdings. This O.F.S. producer which lies to the south of Free State Geduld has long been regarded by many as the leader of the field and the latest payment confirms this view.

The dividend at 60 cents, per 50 cent share, is 5 cents higher than the payment this time last year and brings the total payment for the twelve months ended September 30, 1961 to 105 cents. Western Holdings is in a very strong position for the payments are not the result of a prolonged tax-free holiday but a record level of operating profits. Since last April the monthly operating profits have been above the R2,000,000 mark, and thus, even though taxation has taken some 59 per cent of profits over the past three quarters, the dividend is still covered 1.3 times.

Free State Geduld has just entered the tax paying lists and it had been feared that the rising level of taxation might mean a reduced dividend, in fact, this has not been so, the rate has been maintained at 50 cents. President Brand has also maintained its dividend though its neighbour President Steyn has been forced to cut back from 10 cents to 7.5 cents. This is not surprising due to the rising costs and the heavy capital expenditure programme. At Welkom, with a higher payment last March, the total for the year has been increased though the present dividend has only been maintained. This will have disappointed some, but the most important point is that the final amount of R293,104 has now been set aside for the debenture redemption. With this burden removed the promise for better dividends in 1962 is strong.

The Harmony interim dividend has been maintained at 14 cents. The

interesting feature about the Harmony declaration, however, is the payment of 3 cents from the share premium account, tax free. This is not just a "once only" special payment but the first in a series of payments resulting from the land deal between Harmony and the neighbouring Virginia mine. In total, it is intended to pay out 33 cents per share in eleven equal payments at half-yearly intervals.

This is a very palatable sweetener, particularly as it is a tax-free payment, and it should be taken into account when assessing the value of the Harmony shares. The most satisfactory method would be to subtract from the share price the present value of the remaining ten payments and to base any yield calculations on this lower price. At 6 per cent, the present value of the remaining ten payments is approximately 25 cents (2s. 7d.). On the present London price of 22s. 6d., cum the latest declarations, the normal gross yield is 13.1 per cent. Taking account of the tax-free payment the yield becomes 14.9 per cent.

Below is a table summarizing the latest dividends with the three preceding.

	Mar. 1960	*Sept. 1960*	*Mar. 1961*	*Sept. 1961*
	cents			
F. S. Geduld	35	50	35	50
P Brand ...	25	30	25	30
P. Steyn ...	10	10	7.5	7.5
W. Holdings	40	55	45	60
Welkom ...	2.5	3.75	3	3.75
St. Helena ...	22.5	27.5	23	30
Winkelhaak	—	3.3	5	6
Harmony ...	12.5	13.75	14	14

SUNGEI KINTA ON TRIBUTE

The past year has been most disappointing for Sungei Kinta. After a great deal of consideration it was decided in March, 1960, to change the method of mining from a dredge operation to open-cast. Due to the scattered occurrence of the remaining payable areas it was not economic to employ a dredge which would be forced to cut it's way through unpayable ground to gain access to the relatively small payable areas. Under these circumstances the open-cast method appeared to be the ideal solution and after government permission had been obtained in September of last year the company went ahead and erected the necessary plant.

The preparations were completed towards the end of January and the stripping of the overburden commenced, but operating costs soon proved to be higher than had been anticipated. This was partly due to the unexpectedly heavy rate of water seepage and partly to the difficulty in obtaining skilled labour. These factors combined to reduce the rate of excavation and as a result it was not possible to maintain sufficiently low unit costs. Had the tin recoveries been as expected then it might have been possible to continue but, in the event, the recoveries were lower than the boreholes had indicated and in April, 1961, the company was forced to discontinue operations at the No. 1 mine.

It now appears that the only satisfactory method of mining is gravel pumping and therefore steps are being taken as quickly as possible to conclude agreements with tributors. Already there has been experience with one tributor and the results have been mutually satisfactory.

In looking to the current year the chairman estimates that there may either be a small loss or possibly the operation may break even. In the more distar future the property "should give a goo account of itself for several years to come"

MOUNT ISA DIVIDEND INCREASE

During its financial year to June 30 1960, Mount Isa broke all previous pro duction records and as a result has bee able to increase the dividend paymen despite the lower metal prices tha obtained throughout the year. The grou net trading income increased fron £A9,600,494 to £A10,931,587. The main tained final dividend of 9d. brings the tota for the year to 1s. 3d. per 5s. share a compared with an equivalent of 1s. 1½d the previous year; the 1959/60 interin was paid before the one-for-three scri issue.

This continued improvement is in keepin with the mine's large and as yet uncompleted expansion programme which was fully described in *The Mining Journal* of September 1. This expansion policy is underlined by the increased appropriation to capital account, compared with the previous year the appropriation has been doubled to £A4,000,000.

THE IPOH BATTLE

The Ipoh extraordinary meeting has been held and by a small majority (34.5 per cent for, 33.25 per cent against) the resolutions, removing from the board both the chairman and two directors, were carried. The remaining directors are Mr. J. G. Cowen, who represents the Strait's Trading interest in Ipoh and Mr. Barney Pike who represents Raybar Holdings. The extraordinary meeting

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LEARNER OFFICIAL (MINING)

on the Copperbelt of Northern Rhodesia

DUTIES	The successful applicant will be engaged in studying local methods of underground mining, mining lay-outs, etc.
QUALIFICATIONS	Mining Degree or technical equivalent.
EMOLUMENTS	The commencing basic salary will be £1,080 per annum, rising to £1,145 per annum after one year's practical underground experience PLUS A variable bonus, at present 37 per cent. of basic salary AND A cost-of-living allowance, currently £5 per month. There is a contributory pension and life assurance scheme. Medical and specialist treatment for the employee and his family is provided for a nominal monthly subscription.
LEAVE	41 days per annum (may be accumulated over 3 years' service).
PASSAGE EXPENSES	The company will provide the successful applicant with a free passage out to Northern Rhodesia.

Applications, giving details of age, qualifications and experience, should be sent to:

THE APPOINTMENTS OFFICER,
MINE EMPLOYMENT DEPARTMENT,
SELECTION TRUST LIMITED,
MASON'S AVENUE, LONDON, E.C.2.

Please quote: C.23A.

had been called by Mr. Barney Pike. The background to this meeting was discussed in these columns in our issue of September 1.)

In reply to questions concerning the future of the company Mr. Pike said that he favoured an amalgamation "in some form or other" between Ipoh and its associated tin companies Sungei Kinta and Temoh. He emphasized that there was absolutely no intention of liquidating Ipoh despite its limited life but thought that there might be a diversification of its interests in due course.

KWAHU PRELIMINARIES

With the publication of the preliminary accounts for the year ended June 30, 1961 the directors of Kwahu Mining have announced a proposal to increase the authorized capital from £150,000 to £300,000 and to make a capitalization issue of one new share of 2s. each fully paid for every two stock units held.

For the third year in succession the dividend is being maintained at 30 per cent and following the considerably increased profit on the sale of investments (1961 : £59,007, 1960 : £25,482) £44,136 has been placed to the capital reserve. This profit from the sale of investments has arisen due to the sale to the Ghana government of the company's interest in the Ghana Main Reef Mine. The item dividends and interest received, has fallen from £30,623 in 1960 to £19,669.

The annual meeting will be held in London on October 19.

MCINTYRE LEADS COPPER RUSH

A copper find, which has been located in Quebec's Ungava district, is developing into a staking rush. The first discovery was made by McIntyre Porcupine and already some 1,500 claims have been staked. It lies in the Labrador trough some 15 miles north-east of Fort McKenzie.

McIntyre Porcupine itself has some 400 claims in two groups and within these areas some half a dozen or more separate copper showings have been located, some silver values have also been found. As yet no link has been discovered between the various showings, though the work is at a very early stage. If they do join up then it will be a major deposit.

A syndicate of Area Mines, Locana Mineral Holdings and Miramichi Mines is known to hold about 120 claims both to the north and south of McIntyre's holdings and Conwest Exploration is believed to be acquiring claims. Some of the discoveries represent massive sulphides and it is hoped that with the large prospect teams that are now in the area it will be possible to at least assess the importance of the find this season.

It is not surprising that Locana Minerals should be holding claims adjoining the McIntyre ground. As reported in *The Mining Journal*, March 4, 1960, McIntyre Porcupine and Ventures are important shareholders in Locana, together with Consolidated Mines Selection, Cecil Holdings, Tronoh Mines and Hambros Bank.

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Sir Roy Dobson, vice-chairman and managing director of the Hawker Siddeley Group has stated that the facilities of the Group's two heavy diesel factories, Mirrlees, Bickerton & Day, and The National Gas & Oil Engine Co., are to be combined. Chairman of the new company will be Sir George Briggs, and Mr. C. F. Barnard will be vice-chairman and managing director. Both factories are heavily engaged on export orders in many parts of the world, including electrification of Mauritania's iron ore mines.

Financial News and Results

London Tin Capital Increased.—At an extraordinary meeting of London Tin Corporation resolutions were passed increasing the capital of the corporation and authorizing the issue of one new share for every five shares held.

Ashanti Goldfields.—The authorized capital of Ashanti Goldfields Corporation has been increased from £2,500,000 to £3,000,000 and the issue of 2,497,116 new shares at the rate of one-for-five has been approved. For the purpose of this issue £499,423 4s. has been capitalized from reserves.

De Beers Interim.—The interim dividend No. 83 on the De Beers deferred shares has been declared at 50 cents per share. This is the same as the interim payment made last year and it is anticipated that the total payment for the year will be maintained at 125 cents.

Ayer Hitam.—It has been announced that the company's No. 1 dredge has resumed operation following the conversion to electric drive, the replating of the pontoon and the completion of other minor modifications.

Blinkpoort Gold.—Dividend No. 11 has been declared at 26½ cents. (2s. 7.8d.) bringing the total for the year to 46½ cents (4s. 7.8d.). The total payment for the previous year was 4s. 7½d.

West Wit Areas.—Borehole 22, some 14,000 ft. south of the Libanon Harvie-Watt shaft, on farm Doornkloof intersected the carbon leader at a depth of 10,990 ft. assaying 0.9 dwt. over 54.4 in. This was the first deflection, in the original borehole most of the reef was ground away and it was not assayed. In the second deflection the main reef was intersected at 10,697 ft. giving 0.4 dwt. over 7.7 in. On farm Kleinfontein, borehole E.8.L. 18,000 ft. south-west of

LECTURESHIP IN METALLIFEROUS MINING

UNIVERSITY OF DURHAM KING'S COLLEGE, NEWCASTLE-UPON-TYNE, 1

The Council of King's College invite applications for a Lectureship in Metalliferous Mining, tenable in the Department of Mining Engineering.

Candidates should possess an Honours degree in Mining Engineering or the equivalent, and should have had considerable experience in Metalliferous mining. The commencing salary will be at an appropriate point on the Lecturers' scale £1,050-£1,850 per annum in accordance with age, qualifications and experience of the successful applicant. F.S.S.U. and Child Allowance. The department has considerable facilities for research in several fields.

Further particulars may be obtained from the Registrar and Secretary of King's College to whom applications, together with the names and addresses of three persons to whom reference may be made, should be addressed so as to reach him not later than October 31, 1961. Overseas candidates may in the first instance make application by cable.

CHIEF RESEARCH OFFICER

GEOLOGICAL SURVEY TANGANYIKA

Qualifications : First or good second class honours degree in chemistry, metallurgy or mineral dressing (preference for the latter) and some ten years postgraduate experience in industrial or government laboratories. Experience of supervision of staff and laboratory administration essential; background of mineral extraction and mineral analysis desirable.

Duties : To supervise chemical, mineralogical and mineral dressing laboratories under general direction of Commissioner for Geological Survey.

Terms of Appointment : On contract for one tour of 21-27 months in first instance with salary in scale £2,512-£2,664 p.a. plus 25 per cent gratuity. Free family passages. Government quarters at Rental if available. Education Allowances (e.g. £150 p.a. for child at U.K. boarding school). Free medical attention. Generous home leave. Apply to Director of Recruitment, Department of Technical Co-operation, Carlton House Terrace, London, S.W.1 quoting H1/RC 218/145/02 and stating full name, age, qualifications and experience.

SIERRA LEONE

MINING GEOLOGIST

Qualifications : 1st or good 2nd class honours degree in mining geology with some experience of geochemical and geophysical prospecting techniques. About five years experience as a mining geologist in Precambrian terrains desirable, as well as some knowledge of engineering geology and of mineragraphic techniques. Age limits 25-45.

Duties : Control of prospecting and diamond drilling, direction of geochemical magnetometer, resistivity and ratemeter surveys, and sampling and surveying of mineral deposits and prospects and preparation of reports on them.

Terms of Appointment : On contract for two tours of 15-18 months with salary in scale £992-£1,924 p.a. plus 15 per cent gratuity. Outfit allowance. Free family passages. Quarters at rental if available. Free medical attention. Generous leave.

Apply to Sierra Leone Recruiting Agency, Room 756, Sanctuary Buildings, Great Smith Street, London, S.W.1, quoting H1/RC 218/132/01 and stating full name, age, qualifications and experience.

Doornfontein No. 2 shaft, intersected the carbon leader at 9,100 ft., assaying 13.0 dwt. over 7.4 in., equivalent to 96 in.-dwt. The main reef was intersected in this borehole at 8,764 ft. giving values equivalent to 42 in.-dwt. This borehole is being deflected.

Board Changes

Mr. Wallace H. Smith, a director of Emperor Mines Ltd., Emperor Gold Mining Co. Ltd., Loloma (Fiji) Gold Mines N.L., and Tavua Power Pty. Ltd. since the incorporation of these companies in the mid-1930's, has resigned from the boards because of ill health. Until 1959 he had been Chairman of the two Emperor companies. Mr. Clive Wallace Smith has accepted invitations to join the boards in his father's stead.

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Mr. A. C. Sturney has been elected to the board of International Nickel Co. (Mond) Ltd. He relinquishes his appointment as general manager of publicity, in which office he will be succeeded by Mr. L. F. Denaro.

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Mr. Alexander Macquisten has been appointed a director of Lake View and Star Ltd.

GEOLOGISTS FOR AUSTRALIA

The following vacancies occur for Geological Staff :—

One Senior Geologist. Minimum ten years' experience including minimum five years in the field. Annual salary £A3,250. First-class return fare to Australia. Two Geologists. Minimum two years' experience in the field. Annual salary £A1,850. Return air fares to Australia.

The initial appointments will be for a period of one to two years dependent on results obtained : field expenses including keep will be paid.

Applicants must hold degrees from recognized Universities and special consideration will be given to those with experience in the geology of iron ore deposits. Applications in writing to Box No. 4293, c/o Charles Barker & Son Ltd., 20 Cannon Street, London, E.C.4.

The Compagnie Generale de Geophysique has again increased the range of exploration techniques offered to its clients. This time it has extended its operations into airborne geophysics by retaining the key technicians and specialized equipment of the S.A.R.M., which recently ceased operations. C.G.G. technicians are now undertaking similar work for mineral prospecting. Airborne radiometric methods are also employed.

Tin Company Outputs and Dividends

	Financial year end	Tons of Tin Concentrates produced: This financial year to date	Last financial year to date	Last financial year TOTAL	Dividends declared‡: This financial year to date	Last financial year TOTAL
EASTERN						
Ampat†	Dec.	438·8 (8)	545·8	879·2	—	3/7·2d.
Austral Amal.	June	354·0 (2)	312·0	2060·5	—	—•
Ayer Hitam†	June	2385·0 (12)	1893·8	1893·8	—	1/3d.•
Berjuntai	April	1307·2 (4)	791·0	2726·8	—	—•
Chenderiang†	March	65·2 (3)	58·2	251·8	—	—•
Gopeng Cons.†	Sept.	1578·2 (9)	997·0	1467·2	2/3d.	2/3d.
Hongkong Tin†	Sept.	412·5 (9)	224·2	304·2	—	9d.
Idris H.†	Dec.	179·8 (6)	123·8	339·2	4·5d.	1/6d.
Ipoh Tin†	March	17·2 (3)	131·5	245·8	—	—•
Kampong Lanjut	March	763·0 (5)	574·0	1948·2	—	—•
Kamunting	March	819·8 (5)	697·2	1591·8	—	7·5d.•
Kent (F.M.S.)†	Dec.	193·2 (6)	121·5	267·5	4·5d.	7·5d.
Kepong D.†	June	407·5 (12)	Nil	Nil	—	2/–•
Killinghall†	Sept.	220·0 (9)	310·5	422·5	—	1/3d.
Kinta Kellas	March	59·9 (5)	134·3	286·7	—	1/9d.
Kramat Tin	March	195·5 (5)	289·5	621·2	—	6/–
Kuala Kampur	March	622·2 (5)	598·5	1523·2	—	8/–
Larut Tin	Dec.	203·0 (8)	27·8	119·5	—	6d.
Lower Perak	April	472·8 (4)	539·0	1260·5	—	1/3d.•
Malayan Tin†	June	2751·0 (12)	3299·2	3299·2	—	1/6d.•
Malaysiam†	March	43·4 (5)	54·4	106·3	—	—•
Meru Tin	June	28·5 (12)	36·0	36·0	—	—•
Pahang†	July	2326·7 (11)	2009·8	2252·0	—	6d.•
Pengkalen†	Sept.	452·2 (9)	294·2	391·5	1/1·5d.	1/–
Petaling	Sept.	1053·0 (9)	806·0	1129·8	4·2d.	9·8d.
Rahman H.	June	369·9 (12)	231·9	231·9	—	—•
Rambutan†	June	233·5 (12)	129·5	129·5	—	6d.•
Rantau	June	143·8 (2)	128·0	799·0	—	1/4·8d.•
Renong	June	559·5 (9)	640·5	883·8	—	—•
Selayang	Sept.	12·0 (9)	113·0	118·5	—	2·4d.
Siamese Tin† and subsidiaries	Dec.	1577·0 (8)	1688·0	2681·0	6d.	2/9d.
S. Kinta	March	2060·2 (5)	1554·0	3896·8	—	2/1·2d.•
S. Malayan†	June	3563·5 (12)	2734·8	2734·8	—	2/6d.•
Sungei Besi†	March	372·0 (3)	372·5	2012·8	—	1/6d.•
Sungei Way†	June	1360·0 (12)	1180·5	1180·5	—	4·2d.•
Tanjong†	Dec.	324·2 (6)	481·5	959·8	1/–	4/1·5d.
Tongkah H.	June	293·0 (2)	282·2	309·8	—	3/–•
Tronoh†	Dec.	1982·2 (6)	1754·2	3302·0	2/–	3/6d.
NIGERIA						
Amal. Tin	March	1743·0 (5)	1946·0	4808·0	—	6d.
Columbite		347·0 (5)	267·0	722·0		
Bisichi	Dec.	328·5 (6)	274·5	636·5	—	6.75d.
Columbite		232·5 (6)	187·0	458·0		
Ex Lands	Dec.	350·0 (8)	349·0	540·0	—	8·4d.
Gold and Base	Dec.	521·0 (8)	500·0	751·0	—	0·3d.
Columbite		34·0 (8)	60·0	79·0		
Jantar	Sept.	203·2 (11)	170·0	204·2	—	6d.
Columbite		343·5 (11)	199·1	238·0		
Jos Tin	July	132·5 (11)	125·5	141·0	—	—•
Kaduna P.	Dec.	46·0 (8)	46·5	77·5	—	9d.
Kaduna S.	Dec.	190·0 (8)	173·0	266·0	—	7d.
Naraguta K.	Dec.	34·0 (7)	58·9	117·0	—	—•
U. Tin	March	54·5 (4)	71·0	238·0	—	—•
Columbite		2·5 (4)	5·0	21·0		
MISC.						
Beralt	March	15·0 (5)	27·0	53·0	—	3/–
Wolfram		878·0 (5)	841·0	2079·0		
Geevor	March	269·0 (5)	255·0	657·0	—	2/6d.
Rooiberg	June	1134·0 (12)	1103·0	1103·0	—	5/–
S. Crofty	Dec.	581·0 (8)	547·0	856·0	—	—

• Final dividend not yet declared. † Tons exported. ‡ Up to date at time of going to press.

Contracts Received

Cable Belt Ltd. have received from the National Coal Board an order for a 42 in. cable belt rope driven conveyor which will be just over three miles long and in a single stage with one driving unit. The convevor is to be installed underground at Gedling colliery in the No. 6 Area of East Midlands Division.

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Mirrlees, Bickerton and Day have received an order worth more than £170,000 for four diesel generating sets which will provide power for the gold fields of Kalgoorlie in West Australia. The order was placed on behalf of the principals, North Kalgurli (1912) Ltd., by their consultants, Robert Bruce and Sons. Each set consists of a 1,725 b.h.p. KSS 8-cylinder, HSBT turbocharged diesel with air charge cooling, direct coupled to a 1,220 kW. Brush alternator. Delivery is scheduled for the three months December 1961 to February 1962. The engines are to operate on heavy fuel oil, which is approximately 30 per cent cheaper than diesel fuel, resulting in a substantial decrease in the power charges per ton of ore treated. The station will supply all the power needed to operate the mine winding gear and other equipment, making the mine entirely independent of outside supply. This is Mirrlees' second gold mine installation in the area, the first being at the nearby Great Boulder Mine.

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A contract valued at approximately £200,000 for the design and supply of a coal preparation plant for Compania Carbonifera e Industrial de Lota in Chile has been won by Simon-Carves Ltd., Cheadle Heath, Stockport, in face of world-wide competition. The plant will be capable of handling 4,400 tons of coal each two-shift day and includes hand cleaning for the large coal, Baum washing of two different qualities of coals of intermediate size, together with water clarification and coal handling equipment. The washing capacity is 260 tons an hour of 4 in. and 2 in. coals. Of the different quality coals, one is for metallurgical and the other for industrial use. This is the first contract for coal preparation plant that Simon-Carves has won in South America.

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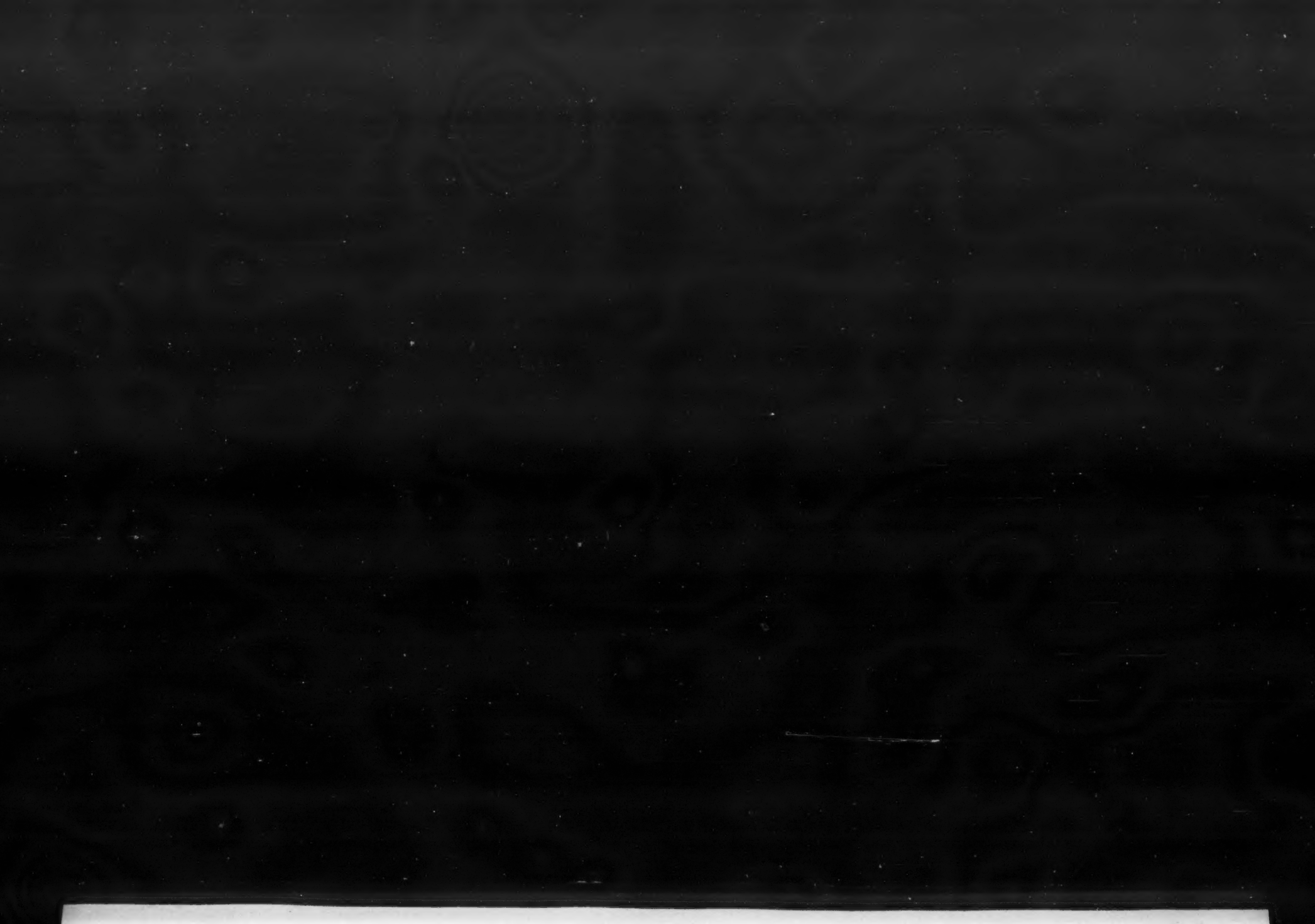
British Moulded Hose Co. Ltd., a subsidiary of BTR Industries Ltd., are again in full production of long length moulded and braided hose at their Watford factory after the fire on June 21.